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FINANCING LONG-TERM CARE THROUGH HOUSING IN EUROPE

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Abstract

To what extent older European would be able to pay for their long-term care needs if they had no access to informal care nor public or private insurance for long-term care? To answer this question, we build a microsimulation model and estimate the disability trajectories of the elderly in 9 European countries using SHARE data. According to the simulations, 57% of the current 65+ will experience disability (defined as being restricted in 2 or plus basic activities of daily living). Conditional on need, care will be required for 4.3 years on average.

7% of dependent individuals with no partner could pay for their long-term care out of their sole income, 23% if they used all their savings except their home. The proportion would double to 50% if they took out reverse mortgages on their main residence. Reverse mortgages could play an important role in Spain and Italy. However, one fifth of individuals could finance less than 5% of their long-term care needs.

Key words: long-term care; housing; reverse mortgage; public coverage; microsimulation.
JEL: J140; D140; I130; C530.

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1. Introduction

If care arrangements are kept constant, public expenditures on long-term care (LTC) are predicted to increase from 1.6% of GDP in 2013 to 2.8% in 2060[1] in the European Union (European Commission, 2015). Maintaining the sustainability of LTC systems is a major challenge in a context of population ageing. The elderly will probably need to consider, at least to some extent, private financing arrangements for their LTC expenses. At first sight, the individual ability to pay for periods of disability appears to be low without public LTC coverage. Indeed, the cost of LTC (between 23,000 and 39,000 euros per year according to our estimates) is generally higher than the average income[2]. In the European Union, 14% of those aged 65 and over were at risk of poverty in 2013 (*i.e.* had incomes below 60% of the national median income). The situation is unlikely to improve given that the public pension replacement rate is projected to decrease by 12 percentage points between 2013 and 2060 (European Commission, 2015). Hussem et al. (2016) simulate the lifetime costs of LTC for Dutch aged 65 and over. They find that, if they had to pay for LTC up to a limit of 100% of their private income, they could cover between less than half and 64% of the costs.

If public health insurance is generalized in most European countries, public universal LTC insurance exists only in very few countries such as Sweden, the Netherlands and Denmark. In France, the reform of 2015 (*Loi d'Adaptation de la Société au Vieillissement*) should result in a decrease in out-of-pocket expenses in the case of home care but the costs will remain high for institutional care. The private LTC insurance market is generally small. Only 7% of LTC expenditures are financed by private LTC insurance in the US, and less than 2% in other OECD countries. The proportion of people aged 40 and over who hold a LTC insurance is about 5% in the US and 15% in France (Colombo et al., 2011). This is partly explained by the unattractiveness of LTC insurance policies (incomplete coverage, unattractive rules of reimbursement…). The poor financial knowledge of consumers, their limited rationality/myopia, the low value put on consumption when dependent, and the existence of potential substitutes for private LTC insurance (family solidarity and social assistance) also reduce the demand (Brown and Finkelstein 2009; Fontaine and Zerrar 2013).

Another reason for the low demand of private insurance is that individuals may plan to use their savings, and particularly their real estate to finance the risk of LTC expenditures.

[1] If a shift from informal to formal care is assumed, public long-term care expenditure could reach 3.6% of GDP in 2060.

[2] In OECD countries, in 2012-13, the income of those aged 75 and over was on average 20% lower than that of the total population (OECD, 2015).

Davidoff (2010, 2009) shows theoretically that home equity, if liquidated in the event of LTC needs, may substitute for LTC insurance. Interestingly, Fontaine et al. (2014) find on French data that the probability of purchasing LTC insurance is 4 to 7 percentage points lower for homeowners living in a house worth over 300,000 euros than for non-owners. Costa-Font and Rovira-Forns (2008) find that housing tenure reduces the probability of insurance demand in Catalonia (Spain). This suggests that homeownership may provide "self-insurance" for LTC (for a detailed discussion, see Laferrère, 2012), all the more since housing is the main part of elderly wealth.

This paper investigates to what extent European elderly are able to pay for their long-term care needs, on the basis of their income, financial assets and home equity. Adopting a life-cycle approach, we assume that individuals take out reverse mortgages when they become dependent, to extract liquidity from their home. Our contribution is threefold. First, using the longitudinal dimension of SHARE, we estimate a disability transition model, taking into account the effect of income and education. Second, we simulate the disability trajectories of those who are 65 and older in 2013, in order to assess their expected lifetime risk of needing LTC. To our knowledge, no other studies estimate the lifetime risk of disability in several European countries, taking into account the effect of the socioeconomic status. Finally, focusing on individuals who have no partner when they are dependent, we study their ability to pay for their LTC needs, assuming no public coverage and no informal care. We assess the role of housing in LTC financing by simulating the lump-sum payments that could be extracted from RMs when individuals become dependent. Since disability trajectories are simulated at the microeconomic level, we can study the dispersion in the ability to pay across individuals.

The article is organized as follows. Section 2 presents the different means to extract home equity and offers a summary of the existing literature on the relationship between housing and LTC financing. Section 3 presents the data and variables used. The methodology is described in Section 4. Section 5 provides the results of the simulations (LTC risk and ability to pay) and alternative scenarios (introduction of informal care and public LTC coverage). The last section is devoted to discussion.

2. Ageing and housing

2.1. Downsizing

Housing is both a consumption and an investment good, illiquid and indivisible. To unlock home equity, homeowners can first "downsize" by selling their house and moving to a less expensive home (as owners or tenants). However, contrary to the predictions of the life-cycle model, housing equity is typically not reduced to support consumption at old age. Venti and Wise (2001, 2000, 1991) show that most older American homeowners do not move. Moreover, the movers generally do not reduce home equity, except when *house-rich* and *cash-poor*. The housing wealth is more likely to be liquidated when precipitating shocks occur. 10% discontinue home ownership when a spouse dies and 35% when a spouse enters a nursing home. The residential mobility of the older European is also low (about 2% per year for households aged 50+) and mainly driven by shocks on health or household composition (Angelini et al., 2014; Angelini and Laferrère, 2012; Bonnet et al., 2010). Older and low-income households seem more likely to reduce housing consumption. Interestingly, elderly homeowners in poor health are more likely to move (Angelini et al., 2014) and, conditional on moving, to choose smaller dwellings (Angelini and Laferrère, 2012). It suggests that they anticipate the risk of disability.

Selling one's home has important psychological costs in old age. It is widely acknowledged (despite the lack of uniform and comparable data) that most people would prefer to *"age in place"*. In Spain, 78% of the elderly aged 55+ would prefer to stay in their home in case of old age dependency rather than living in a nursing home (16%) or in a relative's home (6%) (Costa-Font et al., 2009). In France, 90% of surveyed individuals would prefer to adapt their home, rather than moving to a nursing home (Opinion Way, 2012). In the US, 87% of people aged 65+ want to stay in their home and community as they age (AARP, 2014).

2.2. *Ventes en viager* and home reversion schemes

Equity release schemes enable homeowners to liquidate all or part of their housing equity, while living in their home. They are of two types, home reversions and reverse mortgages. Home reversions are sale arrangements, mainly available in France ("sales *en viager*") and in the UK. The homeowner sells all (in the French case) or part of the home and receives a lump-sum payment and annuities. She retains the right to use the home but ownership is transferred to the buyer (an individual in France, a home reversion company in the UK). This type of sale arrangement is rarely used (see Masson, 2015 and Laferrère, 2012 for reasons of this lack of success). In Europe, the estimated number of home reversion contracts represents

one third of the Equity release schemes market (Reifner et al., 2009). In the UK, in 2014, less than 1% of equity release customers took out home reversions (Equity Release Council, market report spring 2015). In France, the number of sales *en viager* is low (less than 4,000 per year) and is declining (Jachiet et al., 2004).

2.3. Reverse mortgages

Reverse mortgages (RM, called *"lifetime mortgages"* in the UK) are credit operations which, contrary to home reversions, do not imply any transfer of ownership. Homeowners[3] borrow against all or part of the value of their homes. The main difference with regular remortgaging is that the borrower does not need to make any repayments as long as she lives in the home. Contrary to traditional mortgages, interests are added to the loan balance and the debt grows over time. When the (last) borrower dies, sells the house or permanently moves out, the RM is closed and the loan is repaid. The heirs can reimburse the credit to the lender and keep the house. Alternatively, they can choose to sell it and, if the sale price is higher than the debt, keep the difference. The longevity risk and the risk on housing prices are transferred to the lender. Indeed, the borrower's liability is limited to the value of the property at the end of the contract by a no negative equity guarantee. If the loan value exceeds the sale price of the home, the lender is not allowed to seize other assets (non-recourse loan). RM do not require medical or income tests and thus are accessible to poor health and low income individuals who must only have the financial resources to continue paying property taxes and insurance. While a private LTC insurance has to be purchased relatively early (before the disability occurs), RMs can be purchased at very old age, regardless of the health status. Thus, RMs do not require anticipating the risk of LTC expenditures.

RM products have existed for many years in the US and the UK and have been gaining increasing attention in Europe. Overall, the RM market is small, even in the US. But it seems to be increasing due to the development of homeownership, innovation and deregulation in the financial markets (OECD, 2014) and the ageing of baby boomers. In the US, in 2010, 2 to 3 percent of eligible homeowners had a RM (Consumer Financial Protection Bureau, 2012). With a market share of more than 90%, the Home Equity Conversion Mortgage (HECM), insured by the Federal Housing Administration, dominates the US market (Shan, 2011). The number of new HECM loans increased from less than 7,000 in 2000 to more than 110,000 in 2009. After the subprime mortgage crisis, it decreased to about 55,000 in 2012. In Europe, the

[3] Aged 62+ for the US Home Equity Conversion Mortgages, 55+ for the UK Aviva lifetime mortgages, 65+ in France.

RM market represented 3.31 billion euros in 2007 – less than 0.1% of the ordinary mortgage market.

The effect of RM on the economic situation of the elderly seems to be mainly restricted to the oldest age-groups and is higher for single individuals than for couples (Hancook, 1998 on UK data; Sinai and Souleles, 2007; Venti and Wise, 1991 on US data). According to Venti and Wise (1991), reverse annuity mortgage payments would increase by 35% the income of low-income couples aged 85 and over and would double the income of low-income single homeowners. Ong (2008) finds a bigger effect in Australia (+71% on average for homeowners aged 65+). In Europe, if homeowners aged 65 and over converted 100% of their housing wealth at a 7% interest rate, it would decrease their risk of poverty by 23 percentage points in Spain, 18 p.p. in Belgium, 13 p.p. in Italy and 11 p.p. in France. The effect is smaller in Sweden, Austria and the Netherlands (less than 4 p.p.) (Moscarola et al., 2015).

2.4. Housing and LTC financing

Masson (2015) suggests that a specific reverse mortgage product for dependent individuals (*"prêt viager dépendance"*) may help finance LTC costs and support *"ageing in place"* in France (see also Stucki, 2005 for a discussion in the US context). Dependent individuals would provide a medical certificate and, since they have a shorter life expectancy, obtain a more attractive interest rate. In the UK (Aviva lifetime mortgage, the market leader) individuals can borrow a higher amount if they have certain medical conditions or lifestyle factors affecting their health. In addition, Masson stresses that the decision to liquidate part or all of the home equity – and, thus, to reduce inheritance – would be made with the family's agreement. RMs could be used to finance home care, which would reduce the burden of informal caregivers[4]. A limiting factor may be that, with current RM products, the borrower generally needs to repay the loan if she moves permanently to a nursing home (for more than 12 months in the US).

Empirical studies confirm that home equity can significantly improve the ability of dependent individuals to pay for their LTC needs. Stucki (2006) shows that US homeowners who have restrictions in basic activities of daily living have, on average, important home equity (median: $75,000). A RM would provide a lump-sum payment of $30,000 to $49,000. However, home equity will generally not be sufficient to pay the total cost of LTC. Mayhew et al. (2010) study whether households aged 65+ in the UK are able to pay for LTC. They find

[4] See, Lilly et al. (2007) for a review on the consequences of informal care on the labor market. For the effect on caregiver's health, see, for instance, Coe and Van Houtven (2009).

that 400,000 out of 6.5 million can finance more than one year of LTC with their incomes The number increases to 3 million if savings are included and to 4.6 million if housing assets are added. 4.2 million households could afford care for more than three years. These studies are cross-sectional and do not allow assessing the lifetime cost of LTC. They also do not take into account potential differences in the risk of disability according to socioeconomic status. If low income and poorly educated individuals are more likely to face periods of LTC needs, it has important implications in terms of social inequalities and public policies. Indeed, homeownership and housing equity seem to decrease the risk of disability, LTC expenditures and institutionalization (Bockarjova et al., 2014; Costa-Font, 2008; Rouwendal and Thomese, 2013). Thus, RM products may not be adequate for those with the higher needs.

3. Data

This paper uses data from SHARE Waves 1, 2, 3 (SHARELIFE), 4 and 5[5]. SHARE is a longitudinal and multidisciplinary survey on health, socioeconomic status and social and family networks. It provides information on individuals aged 50 and older in 20 European countries, interviewed every two years, and on their partners. The data provide information on limitations with instrumental and basic activities of daily living, which allow measuring the risk of needing long-term care (LTC), and on income, financial and housing assets. Respondents are followed when they enter a nursing home. When they die, an end-of-life interview is conducted with relatives, friends or neighbors.

We focus on those aged 65 and over in wave 5 (2013) in 9 countries: Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, and Belgium (23,769 observations). These countries have been surveyed since the first wave and represent different types of welfare state. Table 1 provides some descriptive statistics. The sample is characterized by a majority of women (57%), individuals in couples (64%), who have children (88%) and an average age of 75.

Variables of interest

Dependent persons in wave 5 are identified using restrictions in basic activities of daily living (ADLs). We consider 6 ADLs (dressing, walking across a room, bathing or showering, eating,

[5] DOIs: 10.6103/SHARE.w1.260, 10.6103/SHARE.w2.260, 10.6103/SHARE.w3.100, 10.6103/SHARE.w4.111, 10.6103/SHARE.w5.100. See Borsch-Supan et al. (2013) for methodological details.

getting in/out of bed and using the toilet)[6] and assume that those who report difficulties with at least 2 activities are in need of LTC. A cutoff of two rather than only one is chosen because the data provide no information on the degree of difficulties and we do not want a too broad definition of disability[7]. In the US, the individuals must need substantial assistance in performing at least 2 ADLs to trigger Medicaid and private long-term care insurance benefits (Brown and Finkelstein, 2007). On average, 10% of the 65+ were dependent in 2013 (Table 1). The proportion was higher in Southern Europe (14% in Spain and 12% in Italy) than in Northern Europe (4% in Sweden, 5% in the Netherlands and 6% in Denmark).

The annual household income (net of taxes and contributions) is the sum of all individual components: earnings from employment, pensions, unemployment and other benefits and transfers. This paper assumes that there is no public LTC coverage, thus we exclude public LTC insurance payments[8]. We compute an equivalised household income by dividing the total income by the weighted number of household members (OECD modified scale). The measure facilitates the comparison of living standards between households of different size and is less likely to change over time.

The survey also provides information on household financial assets net of financial liabilities and net housing assets[9]. The net home value (or home equity), H, is the key variable used to simulate the equity that could be released through RMs[10]. We also take into account the

[6] The question is the following: *"Please tell me if you have any difficulty with these [activities] because of a physical, mental, emotional or memory problem. Again exclude any difficulties you expect to last less than three months"*.

[7] The definition of dependence used in this paper probably covers very different situations. For illustration purpose, in the French Disability and Health Survey (*Enquête Handicap Santé*, 2008), individuals with 2+ ADL limitations report only moderate difficulties in 19% of the cases, at least one important difficulty in 26% of the cases and cannot do alone at least one basic activity of daily living in 55% of the cases (authors' computation).

[8] Only 271 individuals reported public LTC insurance payments.

[9] Homeowners are asked the following: *"In your opinion, how much would you receive if you sold your property today?"*. We adjust this amount for the percentage owned by the respondent and her spouse (100% in 80% of the cases) and mortgages on the main residence (see Eq.1). Around 10% of owners aged 65+ have a mortgage and the average value is 58,000 euros.

[10] It should be noted that homeowners overestimate the value of their homes. Venti and Wise (2001) focus on recent movers and compare sales prices to the respondents' assessments of home value. They find that the home value was overestimated by 15 to 20% based on a comparison of means and by 6 to 7% based on medians. This is confirmed by Benítez-Silva et al. (2015) who show that the overestimation bias is about 8% on average. In the Netherlands, the comparison of actual housing prices with perceived home values suggests that the median homeowner overestimates house prices by 13% (Van der Cruijsen et al., 2014).

ownership of other real estate (secondary homes, holiday homes, land or forestry) that can be sold to finance long-term care needs.

$$H = \%\ owned \times home\ value - value\ of\ mortgages \quad \text{(Eq.1)}$$

Incomes and assets differ widely across Europe (Table 1). The equivalised household annual income ranges between 10,000 euros in Spain and 38,000 euros in Belgium; the value of the net financial assets varies from 12,000 euros in Spain to 114,000 euros in Denmark and the proportion of homeowners goes from 49% in Austria to 92% in Spain. Among homeowners, the net home value is on average 241,000 euros. At first sight, reverse mortgages may help pay for long-term care in Spain and Italy, where income and financial wealth are low whereas homeownership rates are particularly high. In contrast, reverse mortgages will probably be less attractive in Sweden and the Netherlands where income and assets are high and homeownership is lower.

Table 1. Descriptive statistics on European elderly.

Mean (standard deviation) *Median*	Total	Austria	Germany	Sweden	Netherlands	Spain	Italy	France	Denmark	Belgium
Age	75.152	74.874	75.125	74.356	74.211	75.650	74.982	75.519	73.904	75.229
	(7.351)	(7.285)	(6.872)	(7.310)	(7.431)	(7.634)	(7.365)	(7.713)	(7.263)	(7.505)
Female	0.572	0.577	0.562	0.553	0.544	0.579	0.573	0.590	0.540	0.572
	(0.495)	(0.494)	(0.496)	(0.497)	(0.498)	(0.494)	(0.495)	(0.492)	(0.499)	(0.495)
Couple	0.639	0.568	0.676	0.683	0.660	0.605	0.643	0.595	0.682	0.655
	(0.480)	(0.495)	(0.468)	(0.465)	(0.474)	(0.489)	(0.479)	(0.491)	(0.466)	(0.475)
At least one child	0.884	0.880	0.883	0.925	0.911	0.888	0.863	0.888	0.924	0.888
	(0.321)	(0.325)	(0.322)	(0.264)	(0.285)	(0.315)	(0.344)	(0.316)	(0.265)	(0.316)
Education level										
- Pre-primary/primary	0.369	0.179	0.025	0.323	0.173	0.741	0.601	0.454	0.195	0.261
	(0.483)	(0.383)	(0.156)	(0.468)	(0.378)	(0.438)	(0.490)	(0.498)	(0.397)	(0.439)
- Secondary/post-secondary	0.459	0.582	0.713	0.418	0.607	0.194	0.353	0.350	0.474	0.470
	(0.498)	(0.493)	(0.452)	(0.493)	(0.489)	(0.396)	(0.478)	(0.477)	(0.499)	(0.499)
- Tertiary	0.172	0.239	0.262	0.259	0.220	0.065	0.046	0.196	0.331	0.269
	(0.377)	(0.426)	(0.440)	(0.438)	(0.415)	(0.247)	(0.210)	(0.397)	(0.471)	(0.443)
Disability status										
2+ ADLs (dependent)	0.101	0.090	0.098	0.043	0.051	0.137	0.119	0.082	0.060	0.118
	(0.301)	(0.286)	(0.297)	(0.203)	(0.221)	(0.344)	(0.323)	(0.275)	(0.238)	(0.323)
Resources (in euros)										
Equivalised annual household income	19,996	20,789	20,860	32,293	25,009	10,124	12,249	27,725	25,083	37,990
	(59,875)	(14,101)	(15,348)	(18,962)	(28,027)	(8,062)	(15,849)	(128,814)	(14,680)	(49,669)
	15,082	*18,251*	*17,430*	*27,688*	*20,118*	*8,468*	*10,323*	*19,110*	*21,106*	*20,714*
Value of household net financial assets	44,548	22,642	35,471	94,539	109,887	12,042	14,090	80,310	113,627	89,359
	(139,807)	(54,332)	(77,780)	(138,870)	(266,438)	(25,811)	(32,111)	(236,479)	(187,053)	(145,582)
	9,000	*6,223*	*11,500*	*46,141*	*24,000*	*2,584*	*2,881*	*17,300*	*40,225*	*35,000*
Owners (main residence)	0.724	0.490	0.582	0.527	0.589	0.921	0.817	0.779	0.672	0.742
	(0.447)	(0.500)	(0.493)	(0.499)	(0.492)	(0.270)	(0.387)	(0.415)	(0.470)	(0.438)
Net value of main residence (if owner, >0)	241,220	284,247	224,262	236,796	242,856	217,023	231,813	282,178	212,944	286,789
	(246,635)	(234,070)	(165,752)	(220,864)	(140,998)	(452,308)	(152,047)	(191,418)	(170,049)	(129,309)
	200,000	*200,000*	*195,000*	*173,028*	*215,000*	*120,000*	*200,000*	*240,000*	*160,901*	*250,000*
Own other real estate or land	0.179	0.131	0.121	0.307	0.063	0.223	0.171	0.245	0.226	0.193
	(0.383)	(0.338)	(0.327)	(0.461)	(0.243)	(0.416)	(0.377)	(0.430)	(0.418)	(0.395)
Value of other real estate/land (if other real estate)	237,511	246,054	302,679	224,919	216,820	245,300	201,016	219,711	203,710	243,449
	(365,749)	(297,720)	(406,699)	(258,169)	(228,787)	(672,413)	(161,563)	(159,876)	(183,796)	(211,429)
	150,000	*150,000*	*140,000*	*115,352*	*150,000*	*110,000*	*150,000*	*199,537*	*134,084*	*200,000*
Number of observations	23,769	2,417	2,624	2,907	2,206	3,717	2,700	2,435	1,986	2,777

Source: SHARE data, wave 5.
Individuals aged 65 and over.
The statistics are weighted using calibrated individual weights.

4. Methodology

4.1. Transition model

Most existing mortality and disability models depend only on age and sex and have been estimated on US data (Crimmins et al., 2009; Fong et al., 2013; Friedberg et al., 2014; Rickayzen and Walsh, 2002; Robinson, 1996). However, French studies suggest that the education level may impact the incidence of disability and the probability of recovery (Cambois and Lièvre, 2007; Duée and Rebillard, 2006).

Since the objective is to investigate to what extent individuals are able to pay for long-term care, it seems important to take into account the impact of the socioeconomic status on mortality and LTC needs.

Mortality transitions

To estimate the probability of dying, we use the observed mortality in SHARE between waves 1 and 2, 2 and 3, and 4 and 5[11]. The analysis focuses on individuals for whom we know the disability status (dependent or not) in the initial wave and for whom life status is observed two years later, which leaves 31,203 observations (see Table 7 in Appendix A for further details on observed mortality and baseline transition probabilities). The probability of dying is 6.7 percentage points higher for dependent individuals than for non-dependent ones (Table 2). Men and older individuals face a higher risk of death, while a higher income and education level have a protective effect. Transitions to death seem less frequent in France and Belgium. The last variable in the table controls for the duration between the two dates of interview.

[11] Mortality is observed thanks to end-of-life interviews with proxy respondents or from information gathered by the interviewers. Wave 3 questionnaire (SHARELIFE), which focuses on people's life histories, provides no information on ADLs, so transitions between waves 3 and 4 cannot be used. Similarly, estimations of the incidence of disability and the probability of recovery require information on the ADLs both in the initial and final waves and thus do not use transitions between waves 2 and 3 and waves 3 and 4.

Table 2. Transition probabilities between two waves.

	Probability of dying	Becoming dependent (2+ ADLs)	Recovery (No ADL)
Age	0.005*** (0.000)	0.006*** (0.000)	-0.011*** (0.001)
Female	-0.029*** (0.003)	0.012*** (0.004)	0.009 (0.024)
Dependent (2+ ADLs)	0.067*** (0.003)	-	-
Equivalised household income (country level)			
- 1st quintile	-	-	-
- 2nd quintile	-0.006* (0.004)	-0.008 (0.005)	0.045 (0.032)
- 3rd quintile	-0.007** (0.004)	-0.014*** (0.005)	0.012 (0.036)
- 4th quintile	-0.007* (0.004)	-0.023*** (0.005)	0.025 (0.036)
- 5th quintile	-0.010** (0.004)	-0.025*** (0.006)	0.025 (0.040)
Education level			
- Pre-primary/primary	-	-	-
- Secondary/post-secondary	-0.006* (0.003)	-0.016*** (0.004)	0.052* (0.030)
- Tertiary	-0.009** (0.004)	-0.027*** (0.006)	0.026 (0.044)
Country			
- Austria	-	-	-
- Germany	-0.003 (0.006)	0.013* (0.008)	-0.037 (0.054)
- Sweden	-0.004 (0.005)	-0.042*** (0.008)	0.033 (0.055)
- Netherlands	-0.004 (0.006)	-0.036*** (0.009)	-0.083 (0.069)
- Spain	0.003 (0.005)	0.009 (0.007)	0.058 (0.042)
- Italy	-0.003 (0.005)	0.004 (0.007)	0.014 (0.047)
- France	-0.013** (0.005)	-0.021*** (0.007)	0.049 (0.044)
- Denmark	0.008 (0.006)	-0.023*** (0.008)	-0.117* (0.070)
- Belgium	-0.017*** (0.005)	-0.006 (0.006)	-0.077* (0.045)
Time between the two waves - 24 months	0.002*** (0.000)	0.000 (0.000)	0.006** (0.003)
Number of observations	31,203	17,803	1,248

Source: SHARE, waves 1, 2, 4, 5 (+ wave 3 for mortality transitions).
1st column: individuals aged 65 and over and whose status (dependent or non-dependent) is known in the initial wave.
2nd column: individuals aged 65 and over and non-dependent (< 2 ADLs) in the initial wave.
3rd column: individuals aged 65 and over and dependent (2+ ADLs) in the initial wave.
Average marginal effects. Standard errors in parentheses.
*: significant at the 10% level, **: 5% level, ***: 1% level.

Comparisons of estimated probabilities of death by country, sex and age with life tables from the Human Mortality Database show that SHARE underestimates mortality. This is linked to the fact that individuals in institutions are not initially sampled in the survey in most countries, and to panel attrition. A correction factor by country, sex and age[12] is computed to adjust SHARE estimated probabilities to life tables. For example, the mean estimated probability of death (over a two-year period) among French women aged 80 in the sample (54 observations) is 4.25%. In the Human Mortality Database, the two-year probability of dying is 5.91%. Thus, the correction factor is equal to 1.39 (0.0591/0.0425). In the microsimulation, the estimated probability of death of 80 years old French women is multiplied by 1.39. Table 8 in Appendix A provides the mean correction factor in each country. SHARE mortality is particularly underestimated in the Netherlands and in Belgium.

Disability transitions

[12] Individuals aged 85-89 years and 90-99 years are grouped to have a sufficient number of observations. We do not compute correction factors for 100+ years old due to a lack of observations.

The logit models for the probability of becoming dependent[13] and the probability of recovery use observed transitions between waves 1 and 2 and waves 4 and 5 of SHARE (see Table 9 in Appendix A for further details). The estimation of the incidence of ADL limitations focuses on individuals who are non-dependent in the initial wave (< 2 ADLs), who survive between the two waves and whose disability status is known in the final wave. The probability of recovering from disability is estimated on those who are dependent (2+ ADLs) in the initial wave, are still alive two years later and whose number of ADL limitations is known. As defined above, an individual becomes dependent if she reports at least 2 ADL limitations. To recover from disability, a person must report no difficulty in performing basic activities of daily living.

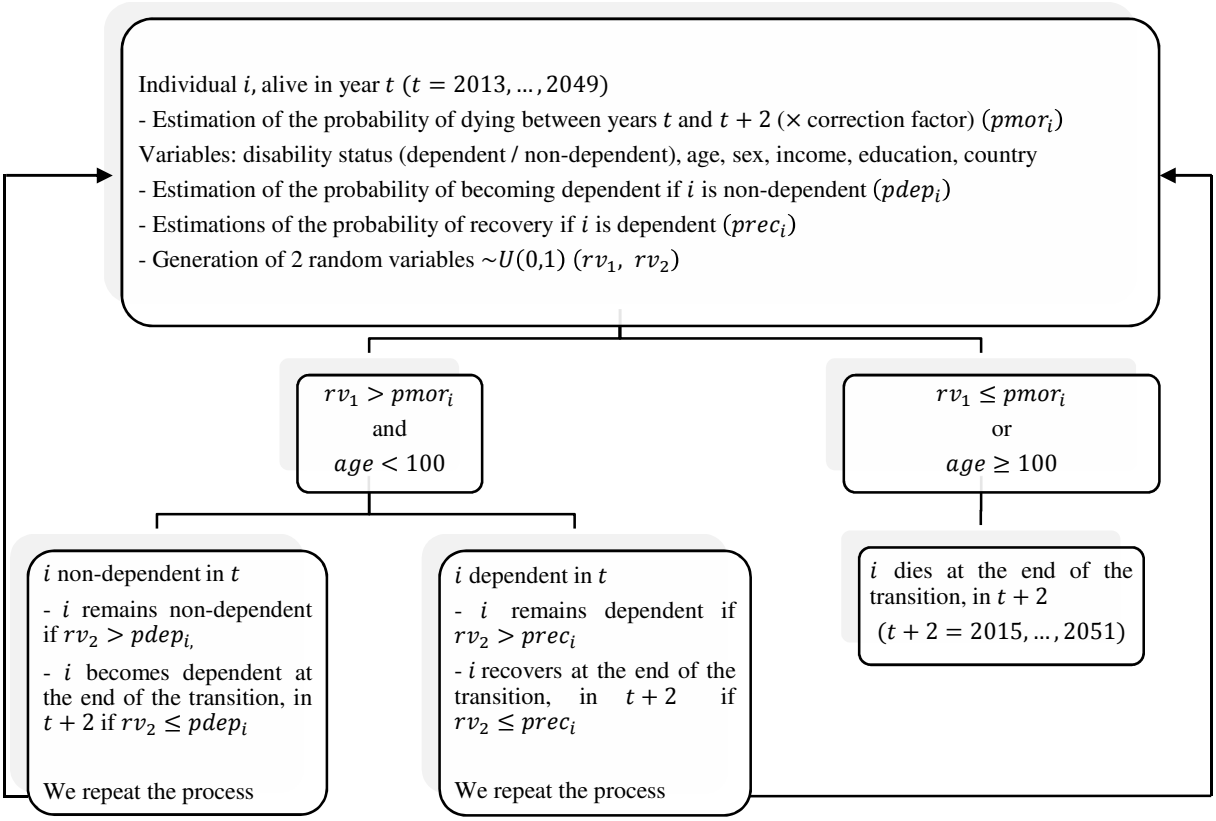
The probability of becoming dependent is higher for women and increases with age (Table 2). Interestingly, individuals with low income or poorly educated face a higher risk of needing long term care. The incidence of ADL disability seems to be lower in Northern Europe and in France. For dependent individuals, the probability of recovery is mainly explained by age. It should be kept in mind that this disability transition model may be biased due to attrition.

4.2. Microsimulation

The disability transition model allows estimating individual probabilities of transitions as a function of age, sex, income, level of education, country and initial disability status. We then simulate disability transitions of individuals over a two-year period by comparing the estimated probabilities with a random variable that follows a continuous uniform distribution on [0;1]. The process is repeated to simulate disability trajectories from 2013 until 2051. Centenarians are assumed to die with probability one so that all wave 5 65+ individuals are dead in 2051 (the simulation process is described in Figure 1 below). The disability transition model assumes no change in disability rates and mortality trends during the simulation period. Since simulations rely on random numbers and may be affected by stochastic variability, the model is run 10 times to obtain more stable and robust results. The results present the mean LTC risk and the mean ability to pay for LTC needs across these 10 replications of simulations. The study of the distribution of ability to pay focuses on the 10^{th} simulation (other simulations give very similar results).

[13] To simplify the analysis, we do not take into account where the disability takes place (at home or in institution). If we do not consider accommodation costs and day-to-day living costs (meal, laundry…) in nursing homes, we can make the assumption that the cost of long-term care is the same at home and in institution.

Figure 1. Description of the microsimulation process.



4.3. LTC cost

The average cost of LTC at the country level has to be estimated. We focus on dependent individuals (2+ ADLs) in wave 5 and calculate how many hours of care per week they need using a conversion table relating restrictions in basic/instrumental activities of daily living to home help needs. Table 10 in Appendix A summarizes the assumptions (based on Pampalon et al., 1991) and provides a comparison with the assessment of needs used in Austrian and German long-term care systems (Carrino and Orso, 2014). We find that, on average, dependent individuals need between 26 hours (in Denmark) and 33 hours (in Spain) of care per week (Table 3). They need 27 hours in France, to be compared to the 31.5 hours of weekly care (from professional workers and/or relatives) reported by beneficiaries of public LTC coverage according to Petite and Weber (2006). Since the time of assistance needed for each activity of daily living is assumed to be the same in each country (this is a kind of "universal" need), the observed differences are entirely due to differences in the type and the number of activity restrictions reported.

The need for care is then evaluated in monetary terms by applying the hourly labor cost in the "Accommodation and food services" sector (Nace Rev. 2 Section I) in each country (Eurostat data, 2012)[14]. The annual cost of LTC ranges between 23,000 euros in Germany and 39,000 euros in Denmark (Table 3)[15]. This cost is generally higher than the average annual income (Table 1) [16]. It is particularly true in Spain and Italy.

We assume that there is no public LTC insurance and no informal care provided by relatives, friends or neighbors. In other words, dependent individuals have to bear the full cost of LTC. Some simulations with public coverage and family care are presented in Online Appendix C6.

Table 3. Average LTC needs and LTC costs in each country.

	Number of observations used	Average LTC need (hours/week)	Hourly labor cost in accommodation and food services (€)	Average annual cost of LTC
Austria	206	27.669	16.8	24,172
Germany	222	26.877	16.6	23,200
Sweden	123	28.669	25.3	37,716
Netherlands	103	26.334	18.2	24,923
Spain	454	33.477	13.8	24,023
Italy	285	28.079	18.0	26,282
France	206	26.557	23.0	31,763
Denmark	121	26.245	28.5	38,896
Belgium	294	26.872	21.3	29,764

Source: SHARE, wave 5 and Eurostat data (2012).
Individuals aged 65+ and dependent (2+ ADLs) in wave 5.
Weighted statistics.

4.4. Simulation of reverse mortgages

We assume that individuals take out a reverse mortgage as soon as they become dependent, at age 85 on average[17]. They can choose between different payment options, mixing lump-sum payments and annuities (see Online Appendix C1). Here, we assume a single lump-sum payment – the most popular option – received at the origination of the RM contract, and that the contract ends with the death of the borrower[18].

[14] Online Appendix C5 provides alternative results for a higher cost of long-term care, using the hourly labor cost in "Human health and social work activities".

[15] This is consistent with Mayhew et al. (2010) who use a weekly cost of care of £500 (33,366 euros per year). In the US, the national median hourly rate is $20 for homemaker services (household tasks) and home health aide services (personal care) (Genworth cost of care survey, 2015).

[16] The reader should keep in mind that we may overestimate the LTC cost. Indeed, we have no information on the degree of restriction in activities of daily living and assume that all individuals need comprehensive care.

[17] In fact, individuals may recover from disability (in particular at younger ages) and will probably use reverse mortgages only when they are sure that their health will continue to deteriorate. To simplify the analysis, we consider that individuals take a reverse mortgage during their first period of disability.

[18] Not when she leaves the home as it is generally the case in the US and in the UK.

The maximum lump-sum amount L that dependent individuals can receive relies on the general rule that the expected sale value of the house should not exceed the accumulated debt at the time of the borrower's death (Eq.2). The lump-sum payment increases with the net value of the main residence (the home equity) H and the growth rate of housing prices g and decreases with the interest rate of the reverse mortgage m and the remaining life expectancy of the borrower e. Indeed, older individuals will repay the loan sooner; hence fewer interests will be accumulated, allowing a higher loan or alternatively a lower interest rate.

$$L = H \times \frac{(1+g)^e}{(1+m)^e}, \qquad m > g \tag{Eq.2}$$

We assume that the lenders do not adjust mortality to a dependent population and determine e from the life tables of the Human Mortality Database (by age in each country). This assumption means that the amount lent will be lower than if the true life expectancy of dependent individuals was used. Indeed, in our simulations, their life expectancy is on average 17% lower than that predicted by life tables for the general population. Moreover, the lender cannot distinguish between male and female life expectancy because, since 2012, unisex pricing is compulsory to ensure "gender equality" (Court of Justice of the European Union, judgment of 1st March 2011).

We assume that people borrow on 100% of the home value and that the growth rate of housing prices g is nul. The reverse mortgage interest rate m is set at 8% and includes all fees (mortgage insurance premium, origination fees, closing costs and servicing fees). A 8% interest rate is consistent with rates observed in the UK[19], US[20], and on French markets and with the values used in the previous literature[21]. These high interest rates may be explained by the small size of the market and by the fact that the lender faces multiple risks: a longevity risk, an interest rate risk and a risk on housing prices. Online Appendix C5 tests the sensitivity of the results to changes in the interest rates and life tables used by the bank and to changes in the growth rate of housing prices

To illustrate Eq.2, consider a French owner of a 200,000 euros house who becomes dependent at age 85. Her expected life expectancy is 7.03 years, not taking into account the fact that she is dependent. If the lender fixes the RM annual interest rate at 8%, she will receive a capital of

[19] In the UK (Aviva lifetime mortgages) the annual interest rate was 7.19% in September 2015.

[20] In the US, the expected interest rate of HECMs has decreased from 9.8% in 1990 to 4.9% in 2012, in line with the decline of the 10-year Treasury rate. The same trend is observed in France. The interest rate fixed by Crédit Foncier was about 8% since 2007 (Ogg, 2012). This rate has recently decreased to 4.8%.

[21] Bishop and Shan, 2008; Hancook, 1998; Moscarola et al., 2015; Ong, 2008; Venti and Wise, 1991.

116,429 euros. In other words, should she die aged 92 (85+7), the debt will be 199,539 euros, about the price of the house. She would have got 16,633 extra euros per year to finance extra consumption and LTC.

4.5. Measure of ability to pay for LTC needs

To study the ability of individuals to pay for their LTC needs, we assume that income and assets are used by decreasing order of liquidity. First, only the income minus food consumption, annual rents and home-related expenditures (variable I) is used. Then, net financial assets F are depleted and real estate RE other than the main residence is sold. When financial assets are used, interests and dividends from financial investments f are deducted from the income. Similarly, rental income r is deducted when real estate is used. Finally, the lump-sum reverse mortgage payment L is taken into account. The ability to pay for D years of disability is based on the comparison of incomes, assets and annual LTC costs C at the time when individuals become dependent (Table 4).

The analysis of the ability to pay for LTC focuses on dependent elderly people who have no partner/spouse. The assumption that there is no informal care is more credible for them. Indeed, single individuals are more likely to take out reverse mortgages. In the US, in the late 2000s, 37% of the borrowers were couples and 43% were single females (Consumer Financial Protection Bureau, 2012).

Table 4. Stylised analysis of the ability to pay for LTC.

Income I	$I < C$	Inability to pay for LTC
	$I \geq C$	Ability to pay for LTC without any restriction
Income I and financial assets F	$I - f \geq C$	Ability to pay for LTC without any restriction
	$I - f < C \; and \; F > 0$ $D = \frac{F}{C - (I - f)}$	Ability to pay for D years of LTC
Income I, financial assets F and real-estate RE (other than the main residence)	$I - f - r \geq C$	Ability to pay for LTC without any restriction
	$I - f - r < C \; and \; F + RE > 0$ $D = \frac{F + RE}{C - (I - f - r)}$	Ability to pay for D years of LTC
Income I, financial assets F, real estate RE and lump-sum reverse mortgage payments L	$I - f - r \geq C$	Ability to pay for LTC without any restriction
	$I - f - r < C \; and \; F + RE + L > 0$ $D = \frac{F + RE + L}{C - (I - f - r)}$	Ability to pay for D years of LTC

Note: To simplify the analysis, we do not subtract from income the repayment of financial debts ($F < 0$). It avoids having to make assumptions about debt repayments and concerns only few individuals (957 individuals in the sample of 65+ in wave 5 have financial debts).

A difficulty is that income and assets are known only in wave 5. Their value when individuals become dependent depends on many factors such as the evolution of inflation, pension

indexation rules, interest rates, housing prices and life histories. We make simplifying assumptions. First, we assume that annual LTC costs (and thus labor costs) do not vary during the simulation period (2013-2051). Second, the equivalised household income remains unchanged, even if the individual loses her spouse (survivors' pensions roughly preserve the living standards of widowed). Finally, after one's spouse death, financial and housing assets do not change if the individual has no children and are divided by two if there are children[22]. In other words, if there are children, the reverse mortgage is computed only on half of the net value of the main residence.

5. Results

5.1. Long-term care risk

According to our model, 57% of those aged 65 or more in 2013 will experience at least one period of LTC needs and, for them, the average number of years with disability is 4.3[23] (Table 5). The probability of needing LTC is higher for women (66%) than for men (46%) and women face longer periods of disability: 4.6 years compared to 3.7 for men. The socioeconomic status plays an important role. In the 1st income quintile, 62% of individuals are expected to become dependent, while the proportion is only 50% among the richest individuals. Similarly, poorly educated individuals have a 65% risk of needing LTC as compared to 46% for individuals who have completed tertiary education. By contrast, the duration of LTC needs seems to be less sensitive to socioeconomic status. It suggests that social inequalities in health persist at very old ages. Finally, the probability and the duration of LTC needs are lower in Northern Europe (Sweden, the Netherlands, and Denmark) than in the South (Spain, Italy). It may partially be explained by the fact that institutional care is more common in Northern than in Southern Europe. Thus, if SHARE imperfectly follows individuals when they enter nursing home, attrition leads to an underestimation of LTC risk in Northern Europe. It is also possible that fewer restrictions in ADLs are reported in the North than in the South of Europe because housing is better adapted to the needs of people with disability. This would also partly explain the socioeconomic gradient.

[22] We abstract from differences in inheritance laws between European countries.

[23] Since transitions are simulated over periods of 2 years, LTC durations are calculated by multiplying the number of periods of LTC needs by 2.

We find a generally higher probability of needing LTC than other studies, probably because of our broad definition of disability. The LTC duration though is rather consistent with previous findings[24].

Table 5. Simulated LTC risk and LTC duration.

	Probability of needing LTC	LTC duration if > 0 (years)
Total	0.571 (0.004)	4.271 (0.030)
Male	0.458 (0.006)	3.726 (0.051)
Female	0.655 (0.009)	4.556 (0.050)
Equivalised household income (country level)		
- 1st quintile	0.622 (0.009)	4.227 (0.080)
- 2nd quintile	0.618 (0.010)	4.263 (0.135)
- 3rd quintile	0.575 (0.013)	4.408 (0.113)
- 4th quintile	0.533 (0.010)	4.196 (0.094)
- 5th quintile	0.504 (0.014)	4.256 (0.082)
Education level		
- Pre-primary/primary	0.645 (0.006)	4.445 (0.085)
- Secondary/post-secondary	0.550 (0.008)	4.155 (0.028)
- Tertiary	0.464 (0.014)	4.114 (0.108)
Country		
- Austria	0.558 (0.008)	4.181 (0.132)
- Germany	0.588 (0.010)	4.164 (0.045)
- Sweden	0.340 (0.007)	3.405 (0.079)
- Netherlands	0.340 (0.012)	3.674 (0.114)
- Spain	0.676 (0.011)	4.826 (0.099)
- Italy	0.630 (0.012)	4.493 (0.124)
- France	0.514 (0.011)	3.835 (0.090)
- Denmark	0.418 (0.008)	4.181 (0.149)
- Belgium	0.554 (0.011)	4.267 (0.078)
Number of observations: 23,769		

Source: SHARE. We simulate trajectories of wave 5 individuals, using the transition model described in Subsection 4.1. Individuals aged 65 and over in wave 5.
The figures given correspond to the means of the (weighted) LTC risk and the (weighted) LTC duration across 10 replications of simulations. Standard deviations between the means of the 10 replications are reported in parentheses.

Among men who experience at least one period of disability, 54% will have to finance 2 years of LTC, 25% will have to pay for 4 years, and 21% will need care for 6 years or longer. For women, the proportions are 43%, 24% and 33%[25]. These results are in line with Brown and Finkelstein (2008) who use a transition model based on 1982-1994 US data and find that the probability of using care for more than 5 years is 17% for men and 31% for women.

[24] While some studies have estimated the risk of nursing home utilization (see, for example, Friedberg et al., 2014 for a summary), the literature on the lifetime risk of disability is relatively scarce. Table 12 in Online Appendix C2 summarizes existing results from the last 10 years (see also Kemper et al., 2005 for some older references).

[25] Computed from the 10th simulation; other simulations give very similar results. Data not shown.

5.2. Ability to pay for LTC

The LTC risk is significant – 57% of individuals will have to finance, on average, 4 years of LTC needs – and care is costly. Focusing on those who have no partner when they are dependent[26] and assuming that there is no public coverage for LTC and no informal care, we study both the proportion of individuals who are able to pay for their periods of LTC needs and the distribution of the ability to pay.

On average, only 7% of dependent individuals can pay for their LTC needs out of their sole income. The proportion increases to 18% if individuals deplete their financial wealth, 23% if they sell their other real estate and to 51% if they take out reverse mortgages on their main residence (Table 6). Thus, half of individuals cannot totally pay for LTC, even if they use all their income and assets. This highlights both the high cost of LTC and the need for additional forms of LTC coverage.

At the country level, the proportion who are able to pay for their LTC needs (with income, assets, and reverse mortgages) ranges from 41% in Austria to 67% in Belgium. In most countries (Austria, Germany, Sweden, the Netherlands, Spain, Italy, Denmark), only 40 to 50% can finance their periods of disability. The proportion is higher in France (63%) and Belgium (67%) where income, financial and housing assets are, on average, higher (see Table 1).

While only 23% of individuals can pay for their LTC needs without using their home equity, the proportion more than doubles when reverse mortgage payments are taken into account. Indeed, the proportion of homeowners is important among older Europeans and the home value is generally higher than income and financial wealth (Table 1). To give an example, dependent homeowners receive an average lump-sum payment of 84,981 euros when they take out reverse mortgages (1st quartile: 35,910 euros, median: 60,456 euros, 3rd quartile: 100,528 euros; see Table 13 in Online Appendix C5). This covers between 1 and 4 years of LTC. Figure 2 shows that the potential role of reverse mortgages is particularly important in Spain and Italy where a large proportion of individuals is *cash-poor* and *house-rich*. In France, the proportion able to finance LTC would double with RM, to around two-third of

[26] The sample includes between 7,568 and 7,698 individuals (depending on the simulation) who had no partner/spouse in 2013 or who face long-term care needs after the death of their partner/spouse (see Table 11 in Appendix A for more details).

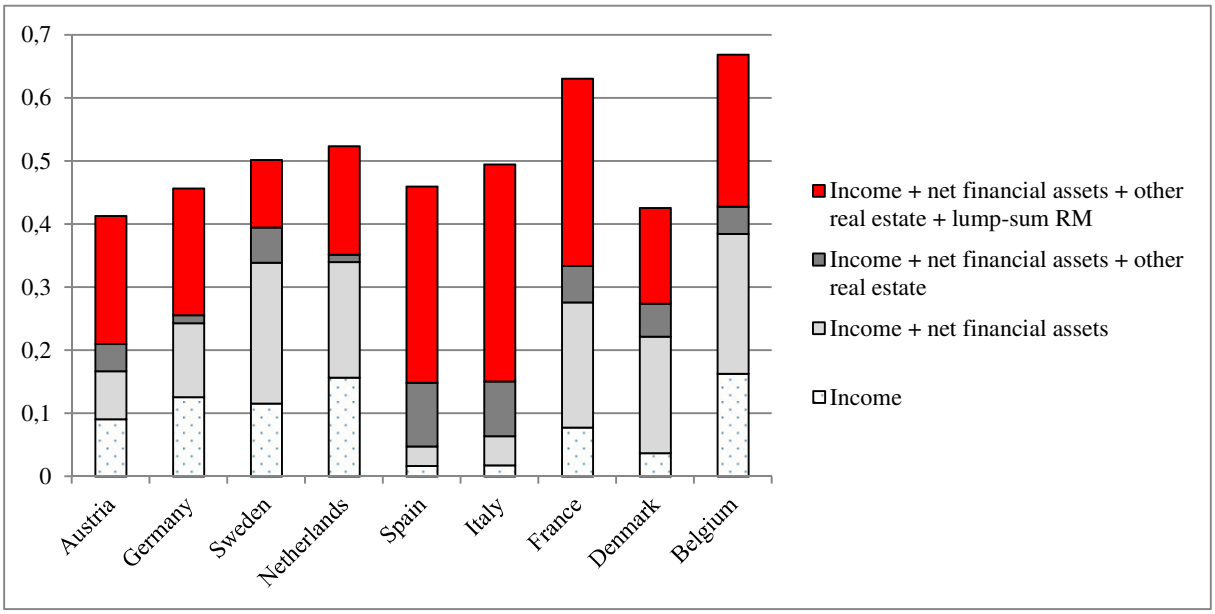
dependent individuals. In contrast, reverse mortgages seem less useful in Sweden where individuals have high incomes and financial assets and are less often homeowners.

Table 6. Proportion of dependent individuals who are able to pay for their LTC needs.

	Equivalised household income	+ Net financial assets	+ Other real estate	+ Lump-sum RM
Total	0.071 (0.004)	0.176 (0.005)	0.234 (0.005)	0.506 (0.009)
Country				
- Austria	0.091 (0.006)	0.167 (0.014)	0.210 (0.015)	0.413 (0.018)
- Germany	0.126 (0.007)	0.243 (0.008)	0.256 (0.008)	0.457 (0.013)
- Sweden	0.116 (0.014)	0.339 (0.017)	0.395 (0.019)	0.502 (0.020)
- Netherlands	0.157 (0.015)	0.340 (0.016)	0.352 (0.015)	0.524 (0.015)
- Spain	0.017 (0.005)	0.048 (0.008)	0.149 (0.015)	0.460 (0.018)
- Italy	0.018 (0.002)	0.064 (0.007)	0.151 (0.010)	0.495 (0.018)
- France	0.078 (0.011)	0.276 (0.016)	0.334 (0.008)	0.631 (0.015)
- Denmark	0.037 (0.006)	0.222 (0.008)	0.274 (0.008)	0.426 (0.007)
- Belgium	0.163 (0.015)	0.385 (0.013)	0.428 (0.012)	0.669 (0.013)
Number of observations: between 7,568 and 7,698 depending on the simulation.				

Source: SHARE, authors' microsimulation.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent.
The figures correspond to the mean of the (weighted) ability to pay across 10 replications of simulations. Standard deviations between the means of the 10 replications are reported in parentheses.
Reading: In Austria, 9.1% of dependent individuals on average can pay for their LTC needs with their income. The proportion goes to 16.7% when net financial assets are added, to 21% if real estate is taken into account and to 41.3% if lump-sum reverse mortgages on the main residence are added.

Figure 2. Proportion of dependent individuals who are able to pay for their LTC needs.



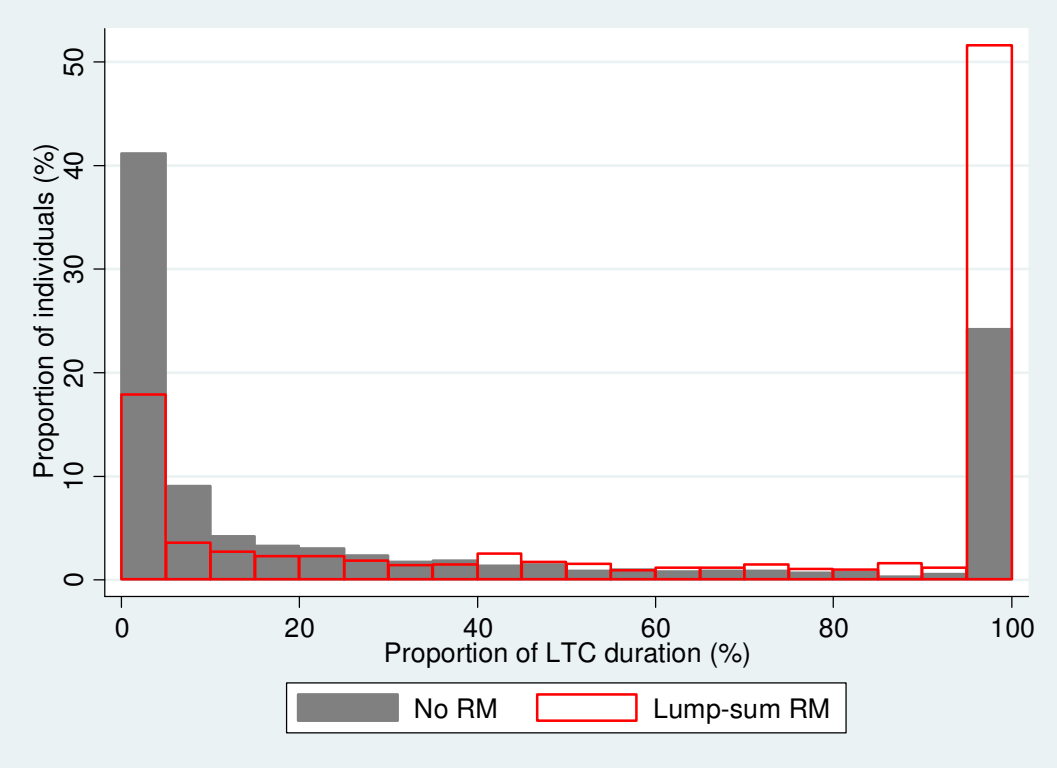
Source: SHARE data, authors' microsimulation.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent.

Beyond the proportion of individuals who can finance their LTC needs, it is interesting to study the distribution of the ability to pay. The proportion of LTC duration that individuals are able to finance is defined as the ratio between the number of years of LTC (D) they can pay for (see Subsection 4.5) and their effective LTC duration. Without home equity, 41% of

dependent individuals can finance less than 5% of their LTC duration, 9% can finance 5 to 10% and 24% can pay for 95% and more of their periods of LTC needs (Figure 3). When lump-sum reverse mortgage payments are added, these proportions reach, respectively, 18%, 4% and 52%. More generally, reverse mortgages increase the proportion of individuals who can pay for 40% and more of their LTC duration to 67% (as compared to 33% without reverse mortgages). To sum up, a significant proportion of dependent individuals can only pay for a very small part of their LTC expenditures, even if they take out reverse mortgages. As 40% of the expected LTC duration is, according to our estimate, approximately 2 years, it means that two-thirds of the population would be able to pay for 2 years of expenses. This gives some interest to a public policy that would ask people to pay for their LTC expenses for two years, or up to a cap on their expenses, and then cover 100% of expenses above this duration. The 33% of the population unable to pay would be covered by public insurance from the onset of LTC needs. Such full insurance system for high risk above a deductible minimum is what is suggested by the theory of health insurance (Arrow, 1963) and is in line with the Dilnot Report (2011) that made a similar suggestion in Britain. In France, the Fragonard Report (2011) suggests to cover all expenses after a certain duration of stay in nursing homes.

Distributions by country (see histograms, Figure 4 in Online Appendix C3) highlight that the ability to pay for LTC needs without reverse mortgages (in grey) is particularly low in Spain and Italy, compared to other countries. In all countries, lump-sum payments from reverse mortgages shift the distribution to the right and improve the ability to finance periods of disability (in red), but not in the same proportion everywhere. As outlined above, the effect of reverse mortgages is small in Sweden and the Netherlands (the red and grey distributions are close). By contrast, the impact is larger in Southern Europe. Austria, Germany, France, Denmark and Belgium constitute an intermediate group.

Figure 3. Proportion of LTC that dependent individuals are able to finance.



Source: SHARE data, authors' microsimulation. All countries.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent (7,620 individuals).
The distribution corresponds to the 10th simulation. Weighted distributions.

Ability to pay for long-term care needs by income quintile

Since the poorest individuals face a bigger risk of disability and have less housing wealth, socioeconomic inequalities may increase at older ages. What would be the consequences of the development of reverse mortgage products, in the absence of public LTC coverage, on the distribution of ability to pay in the different income quintiles?

In most countries (except in Spain and Italy), in the top income quintile, reverse mortgage payments have only a small effect on ability to pay (Figure 5 in Online Appendix C4). These individuals have enough income and financial wealth. In Sweden, the Netherlands and Belgium, in some simulations, all top income quintile individuals are able to pay for their LTC needs with their income and financial assets. In contrast, in Spain and Italy, even the richest individuals are generally not able to finance their periods of disability out of their income and financial wealth. The proportion strongly increases when housing assets are taken into account.

By contrast, reverse mortgage payments play an important role in the other income quintiles. Indeed, the proportion of homeowners is important even among low-income individuals. Among 65+, the average proportion of homeowners is 61% in the 1st income quintile, 67% in

the 2nd quintile, 71% in the 3rd quintile, 80% in the 4th quintile and 82% in the 5th quintile. However, even with reverse mortgages, the proportion of people who can totally pay for their periods of disability is very low, in particular in the first three quintiles of income.

The distributions (Figure 6 in Online Appendix C4) for the first two income quintiles suggest that reverse mortgage payments strongly decrease the proportion of individuals that can pay only for a very small part of their LTC needs and increase partial and total ability to pay for LTC. In the 3rd, the 4th and the 5th income quintiles, reverse mortgages mainly increase the proportion of individuals who can (almost) totally pay for LTC and the shift in the distribution is smaller for the richest individuals. To sum up, reverse mortgages improve the ability to pay for LTC needs at all income levels, but the proportion of people who can totally finance their periods of disability remains low in the first three income quintiles.

Sensitivity tests

As discussed in Section 2, since dependent individuals have a shorter life expectancy[27]. If the bank uses accurate life tables, it may be willing to offer a lower interest rate than that on the general population. Then, the offered lump-sum will be higher. Online Appendix C5 tests the sensitivity of the results to changes in the interest rate and in life tables used to compute reverse mortgages. It also simulates the effect of a change in the evolution of housing prices and in the annual cost of LTC. The results are robust to changes in parameters and the main conclusions remain unchanged. The most important factor is the evolution of housing prices. As it may vary with location, the analysis of this effect is left for future research.

The role of informal care and public LTC coverage

In the main analysis, we assumed that there was no informal care and no public coverage for LTC. Some simulations taking these two elements into account can be found in Online Appendix C6. To account for informal care, we simply assume that the LTC cost borne by dependent individuals is 25% or 50% lower when they had children in wave 5. The proportion of dependent individuals being able to pay for their LTC expenditures raised from 51% to 57% (LTC cost 25% lower) and 67% (LTC cost 50% lower). To introduce public coverage, we mimic a simple income-tested system and assume that 80% of the LTC cost is public covered for individuals in the 1st income quintile, 60% for the 2nd quintile, 40% for the third

[27] As outlined above, in our simulations, the life expectancy of individuals who become dependent is on average 17% lower than that predicted by life tables for the general population

quintile, 10% for the 4th quintile and 5% for the 5th quintile. 69% of dependent individuals can totally finance their LTC expenses with public coverage, as compared to 51% in the baseline scenario. Quite obviously, the ability to pay for LTC significantly increases when part of the cost is publicly financed. In addition, since we have assumed that copayments increase with income, public LTC coverage reduces social inequalities. The ability to pay for 100% of expenses doubles in the two lowest quintiles and is increased by one third in the third one. As expected, there is almost no effect in the two top income quintiles.

6. Conclusion

In a context of financial pressures on social protection systems, reverse mortgages would allow shifting part of the burden of long-term care (LTC) financing on older generations, rather than increasing the contribution of future generations. However, our projections show that half of the population could not finance all their LTC expenses, even if they used all their income and assets. One fifth of dependent individuals could finance less than 5% of them. It highlights the need for insurance coverage, public or private.

The link between private and public financing of formal care and the provision of informal care should be underlined. By reducing the expected inheritance of children, RMs may weaken incentives to provide informal care (Bernheim et al., 1985). On the other hand, the parents may threaten the children to liquidate their home to receive more attention. Furthermore, public LTC benefits may crowd-out the purchase of RMs. Likewise, a means-tested public insurance program may affect wealth accumulation. The proportion of homeowners is particularly high in Mediterranean countries, where public LTC expenditure is low and elderly must rely on their children and their assets. Homeownership is lower in Northern countries, where LTC systems are generous. This suggests that individuals incorporate public policies when taking economic decisions. Thus, public LTC coverage appears implicitly in this analysis.

RM can be perceived as "anti-family" because of the risk that the children will have to give up the family home (Assier Andrieu and Gotman, 2009; Masson, 2015). Dillingh et al. (2013) show that having offspring decreases the probability of being interested in RMs in the Netherlands. However, the proportion of inherited homes is low and has been declining over time (Angelini et al., 2013). In many countries inheritance taxes already eat up part of the estates.

On the other hand, care preferences may also influence the demand for RMs. Many parents declare they do not want to be a burden for their children. RMs may allow dependent elderly to purchase formal home care and preserve their autonomy. Children could provide emotional support and help with domestic tasks, complementing professional care. Furthermore, children may prefer to receive a smaller share of the inheritance rather than provide care to their parents, sometimes at the expense of their health and career.

In practice, the RM market is very small. The most common explanation is that costs and fees are too high. The product also appears complicated and risky both for lenders and borrowers. The demand for RMs is likely to remain low in Europe, unless financially more attractive products are developed in link with the tax system.

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Appendix A. Additional details on the methodology.

Table 7. Observed mortality between waves 1-2, waves 2-3, and waves 4 and 5.

Initial status	Final status			
	Alive	Deceased	Missing information	Total
< 2 ADLs (non-dependent)	**27,587**	**1,129**	6,711	35,427
	(0.779)	(0.032)	(0.189)	
2+ ADLs (dependent)	**1,906**	**581**	738	3,225
	(0.591)	(0.180)	(0.229)	
Alive (disability status unknown)	77	8	137	222
	(0.347)	(0.036)	(0.617)	
Total	29,570	1,718	7,586	38,874
	(0.761)	(0.044)	(0.195)	

Source: SHARE, waves 1, 2, 3, 4, 5.
Individuals aged 65 and over in the initial wave.
Figures without parentheses represent the number of observations. Percentages in line are reported in parentheses.
Figures in bold correspond to the observations used to estimate the transition model.

Table 8. Correction factor for the probability of mortality.

	Mean (standard deviation)	Min	Max
Total	1.475 (0.335)	0.592	2.388
Country			
- Austria	1.353 (0.228)	0.976	1.832
- Germany	1.540 (0.188)	1.166	1.884
- Sweden	1.572 (0.239)	0.996	1.935
- Netherlands	1.783 (0.257)	1.365	2.323
- Spain	1.008 (0.147)	0.592	1.263
- Italy	1.291 (0.203)	0.904	1.586
- France	1.541 (0.262)	0.994	2.122
- Denmark	1.294 (0.156)	0.969	1.696
- Belgium	1.897 (0.240)	1.392	2.388

Source: SHARE, waves 1, 2, 3, 4, 5 and life tables from the Human Mortality Database.
Individuals aged 65 and over in wave 5.

Table 9. Observed disability status transitions between waves 1-2 and waves 4 and 5.

Initial disability status	Final disability status					
	Non-dependent	Dependent	Alive (disability status unknown)	Deceased	Missing information	Total
< 2 ADLs (non-dependent)	**16,783**	**1,020**	1,336	812	5,176	25,127
	(0.668)	(0.041)	(0.053)	(0.032)	(0.206)	
2+ ADLs (dependent)	**272**	**976**	118	378	591	2,335
	(0.116)	(0.418)	(0.051)	(0.162)	(0.253)	
Alive (disability status unknown)	0	0	58	5	118	181
	(0.000)	(0.000)	(0.320)	(0.028)	(0.652)	
Total	17,055	1,996	1,512	1,195	5,885	27,643
	(0.618)	(0.072)	(0.054)	(0.043)	(0.213)	

Source: SHARE, waves 1, 2, 4, 5.
Individuals aged 65 and over in the initial wave.
Figures without parentheses represent the number of observations. Percentages in line are reported in parentheses.
Figures in bold correspond to the observations used to estimate the transition model.

Table 10. Hours of care needed for different activities of daily living (per week).

SHARE activities of daily living	Assumptions used in this paper	Pampalon et al. (1991)	Austrian assessment of needs (Carrino and Orso, 2014)	German assessment of needs (Carrino and Orso, 2014)
Bathing/showering	4	4	6.25	6.53
Dressing	4.67	4.67	5	Unspecified
Using the toilet (+ transfers)	7	7	Unspecified	4.67
Eating	14	14	7.5	5.95
Getting in/out of bed	4.67	4.67	3.75	0.47
Walking across a room	3.5	3.5		Unspecified
Shopping for groceries	1.63	3.25	2.5	Unspecified
Preparing hot meal	3.5	7	7.5	Unspecified
Doing work around the house or garden	6	12	7.5	Unspecified

Source: Carrino and Orso (2014), Pampalon et al. (1991).
We divide by 2 Pampalon et al.'s hours of care needed for shopping, preparing meals and doing work around the house and garden. Compared to 1991, more and more ready-made meals and household appliances are cheaply available, reducing such time costs. We also wanted to limit the overestimation of LTC costs.

Table 11. Sample selection for the analysis of ability to pay (10th simulation).

Situation in 2013 (wave 5).		At least one period of disability (10^{th} simulation)	No partner/spouse when they are dependent (10^{th} simulation)
No partner/spouse	7,466	4,326	4,326
Couple (partner/spouse interviewed)	12,440	6,247	2,468 who become dependent after the death of their partner/spouse + 826 whose partner/spouse dies when they are dependent
Couple (partner/spouse not interviewed)	3,863	1,647	Date of death of the partner/spouse unknown
Total	23,769	12,220	**7,620**

Source: SHARE, authors' microsimulation.
Individuals aged 65 and over in wave 5.
The figure in bold corresponds to the observations used to study ability to pay (in the 10^{th} simulation).

Online Appendix C1. Various forms of reverse mortgages

In the US (Home Equity Conversion Mortgage, HECM), for adjustable interest rate mortgages, borrowers can select one of the following plans: tenure payment (equal monthly payments as long as the individual lives in the home, also called reverse annuity mortgage), term payment (equal monthly payments for a specified period of time), line of credit (unscheduled payments at times and in amount of the borrower's choosing until the line of credit is exhausted) or some combination of term/tenure payment with a line of credit. In late 2007, fixed-rate HECMs, in which the borrower receives a single lump sum disbursement, have been introduced. In the UK (Aviva fixed-rate lifetime mortgages), cash can be accessed as a one-off lump-sum payment or as a combination of an initial lump-sum and access to more releases in the future. In France (Crédit Foncier, the only provider of RM), borrowers can choose between an annuity and a lump-sum payment. Here, we focus on one-off lump-sum payments, which is the most popular option. In the US, in 2007, *"87 percent of borrowers chose a line of credit, and 13 percent chose a monthly disbursement plan. […] The median [line-of-credit] borrower […] took out 82 percent of their available funds within the first year, and three-quarters of borrowers took at least half of their available funds within the first year. Starting in early 2009, the fixed-rate product [introduced in late 2007], which requires a lump-sum disbursement, began to dominate the market. During fiscal year 2011, 69 percent of loans originated were fixed-rate, lump-sum […]"* (Consumer Financial Protection Bureau, 2012). The lump-sum option is also less risky for the borrower if the lender goes bankrupt (Mitchell and Piggott, 2004).

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Online Appendix C2. LTC risk and duration in the literature.

Table 12. LTC risk and duration in the literature.

Model	Data sources	Definition of LTC needs	Probability	Duration (if >0)
This study	European data (SHARE waves 1 to 5)	2+ ADLs	Total: 57% Male: 46% Female: 66%	Total: 4.3 Male: 3.7 Female: 4.6
Kemper et al., 2005	US data (Numerous datasets. Disability transitions and mortality rates are estimated using the 1994 National Long-Term Care Survey)	1+ ADL limitations, four IADL limitations, or using formal LTC services	Total: 69% Male: 58% Female: 79%	Total: 3 Male: 2.2. Female: 3.7
Duée and Rebillard, 2006	French data (*Handicap-Incapacité-Dépendance* 1998-2001 + Destinie model)	Levels of dependence 1 to 4 on the AGGIR scale (help needed for ADLs on a regular basis)	Total: 41% Male: 29% Female: 52%	Total: 4.4 Male: 3.7 Female: 4.7
Brown and Finkelstein, 2004, 2008	US data (Actuarial model of health and care transition probabilities developed by the Society of Actuaries' long-term care insurance valuation methods task force. 1982-1994 National Long-term Care Surveys and 1985 National Nursing Home Survey)	The authors do not study the risk of having LTC needs but the probability of care utilization (nursing home, assisted living, home health care), which is likely to be lower. In addition, they consider only reimbursement-eligible care utilization (care received by individuals who need substantial assistance in at least 2 ADLs).	Total: - Male: 40% Female: 54%	Total: - Male: 2.9 Female: 4.2
Fong et al., 2013	US data (Health and Retirement Study, 1998-2010)	2+ ADLs	Total: - Male: 37% Female: 54%	-

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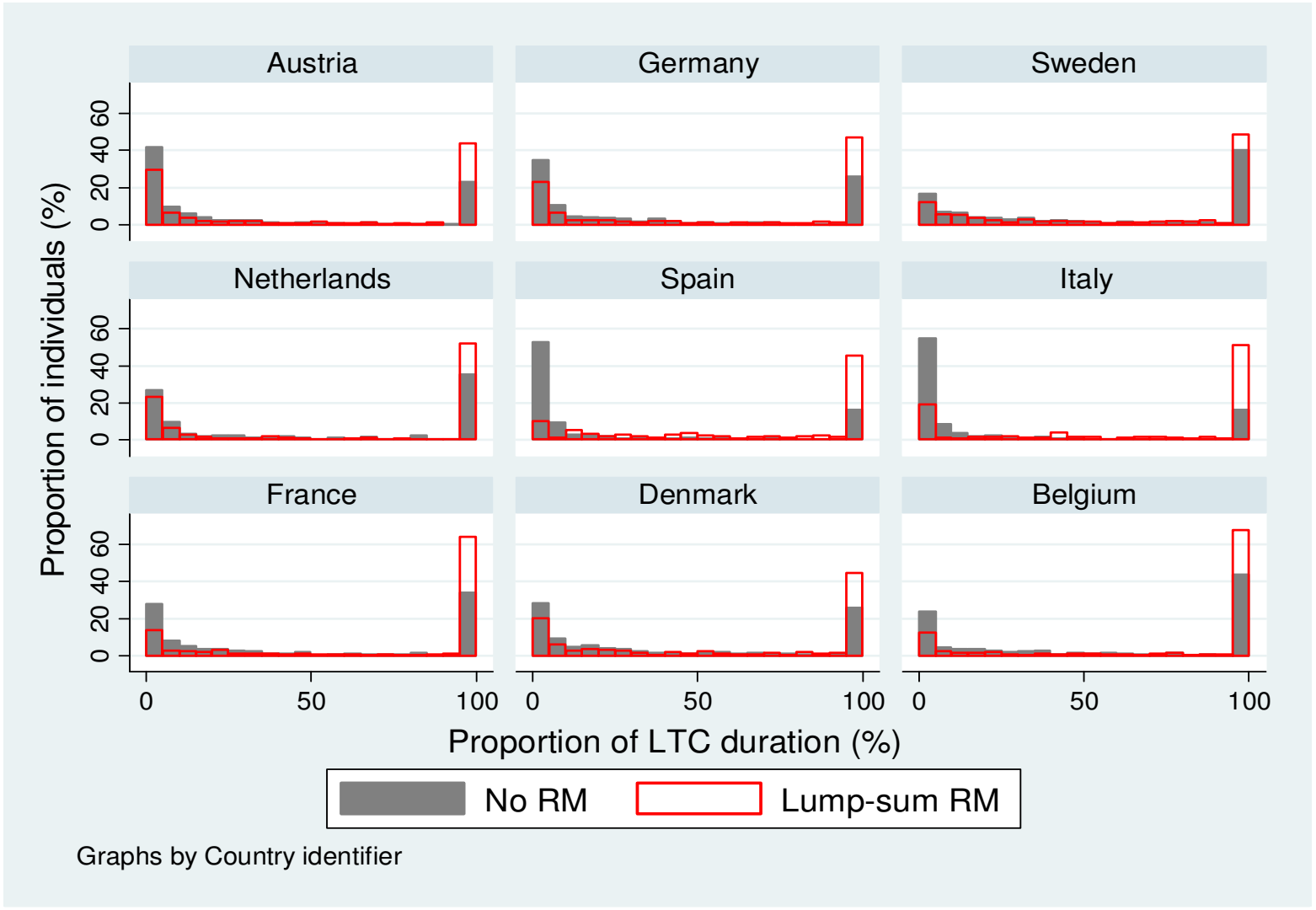
Online Appendix C3. LTC duration that dependent individuals are able to finance at the country level.

Figure 4. Distribution of ability to pay by country.



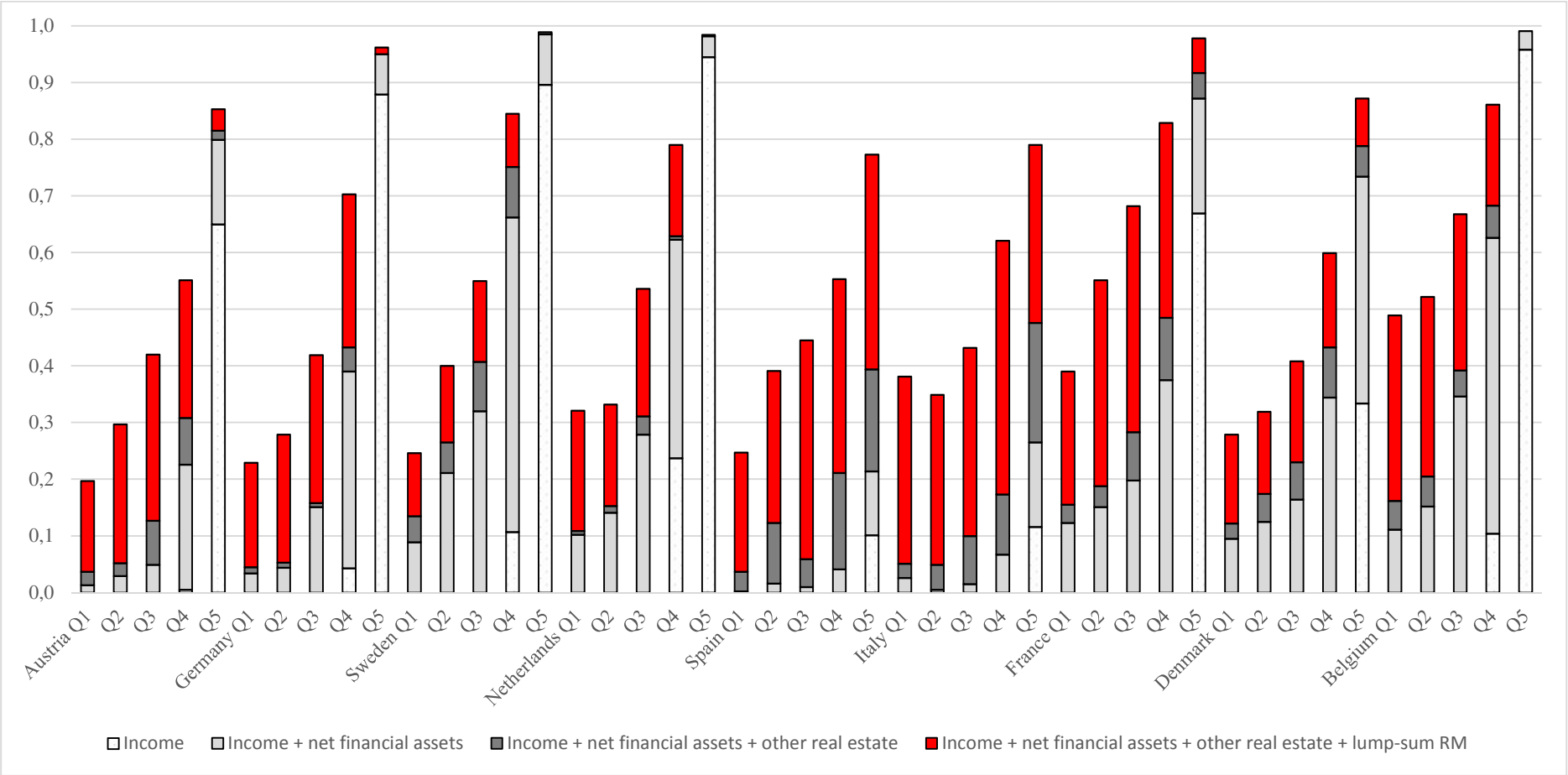
Source: SHARE, microsimulation (lower bound of LTC cost).

Individuals aged 65 and over in wave 5 and who have no partner when they are dependent (7,620 individuals).

The distribution presented here corresponds to the 10th simulation. Weighted distributions.

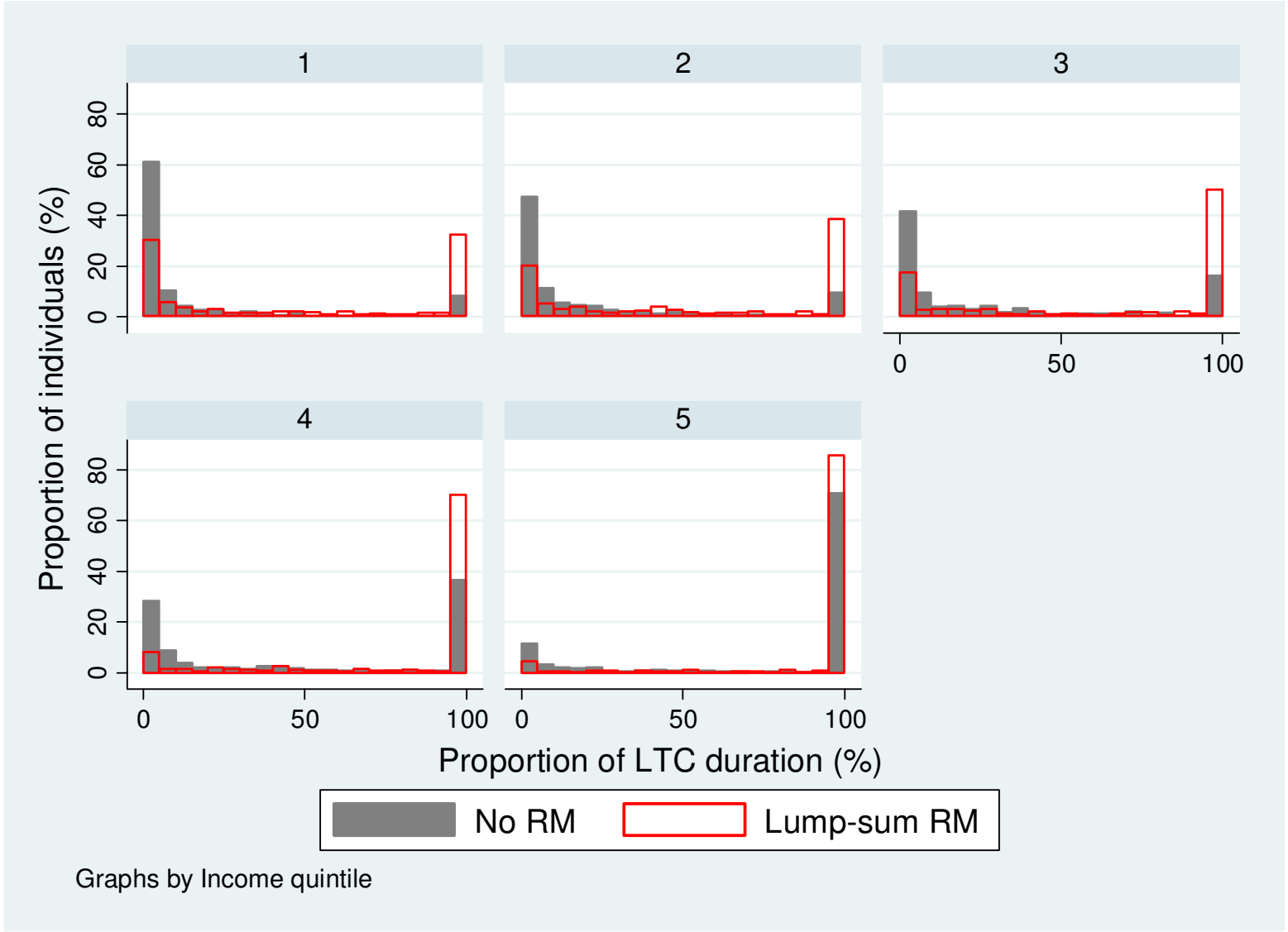
Online Appendix C4. Ability to pay for long-term care needs by income quintile.

Figure 5. Proportion of dependent individuals who are able to pay for their LTC needs, by income quintile.



Source: SHARE, authors' microsimulation.
Individuals aged 65 and over in wave 5 and who have no partner when they become dependent.

Figure 6. Distribution of ability to pay by income quintile.



Source: SHARE, microsimulation (lower bound of LTC cost). All countries.

Individuals aged 65 and over in wave 5 and who have no partner when they are dependent (7,620 individuals).

The distribution corresponds to the 10th simulation. Weighted distributions.

Online Appendix C5. Sensitivity tests

This Appendix tests the sensitivity of the results to changes in the interest rate (4% instead of 8%) and in life tables (20% lower life expectancy than in the Human Mortality Database) used to compute reverse mortgages. It also simulates the effect of a change in the growth rate of housing prices (+/-5% per year instead of 0%). Finally, this Appendix provides alternative results for a higher cost of long-term care, using the hourly labor cost in "Human health and social work activities" (Nace Rev. 2 Section Q) rather than in "Accommodation and food services" (Eurostat data, 2012). This leads to a cost of LTC which ranges between 39,000 and 49,000 euros per year (as compared to 23,000-39,000 euros in the baseline scenario).

Table 13. Effects of a change in RM parameters (interest rate, remaining life expectancy and evolution of housing prices) on the distribution of the lump-sum amount that dependent individuals can receive (€).

	Distribution of home equity	Distribution of lump-sum amount (baseline)	Lump-sum amount (m: 4%)	Lump-sum amount (e: -20%)	Lump-sum amount (g: 5%)	Lump-sum amount (g: -5%)
P10	35,000	20,100	26,742	22,758	29,078	13,238
P25	60,000	35,910	46,134	39,987	49,736	24,598
P50	100,000	60,456	76,380	66,013	81,790	44,111
P75	150,000	100,528	124,406	109,472	132,141	76,013
P90	250,000	156,696	197,297	172,360	214,314	117,640
Mean	133,443	84,981	105,412	92,671	112,504	64,371
Number of observations: 4,896.						

Source: SHARE, authors' microsimulation.
Homeowners aged 65 and over in wave 5 and who have no partner when they are dependent.
The distribution corresponds to the 10th simulation. Weighted distribution.
Reading:

Table 13 above summarizes the lump-sum amounts that dependent individuals receive for different levels of interest rates, life expectancy and housing prices. The mean lump-sum payment is 84,981 euros in the baseline scenario, 105,412 euros if the interest decreases to 4% and 92,671 euros if the life expectancy is 20% lower. If housing prices are expected to decrease, the lump-sum payment is lower (64,371 euros), while it higher (112,504 euros) when housing prices increase.

The ability to pay remain stable when RM parameters are changed (Table 14). In the baseline scenario, 51% of individuals can pay for their periods of LTC needs. This proportion is equal to 54% if we use a 4% interest rate and to 52% if we use a 20% lower life expectancy. It ranges between 45% and 55% depending on the evolution of housing prices. The distributions of ability to pay, in Figure 7, are very similar. This is explained by our assumption that individuals take out reverse mortgages when they become dependent. The lump-sum payment

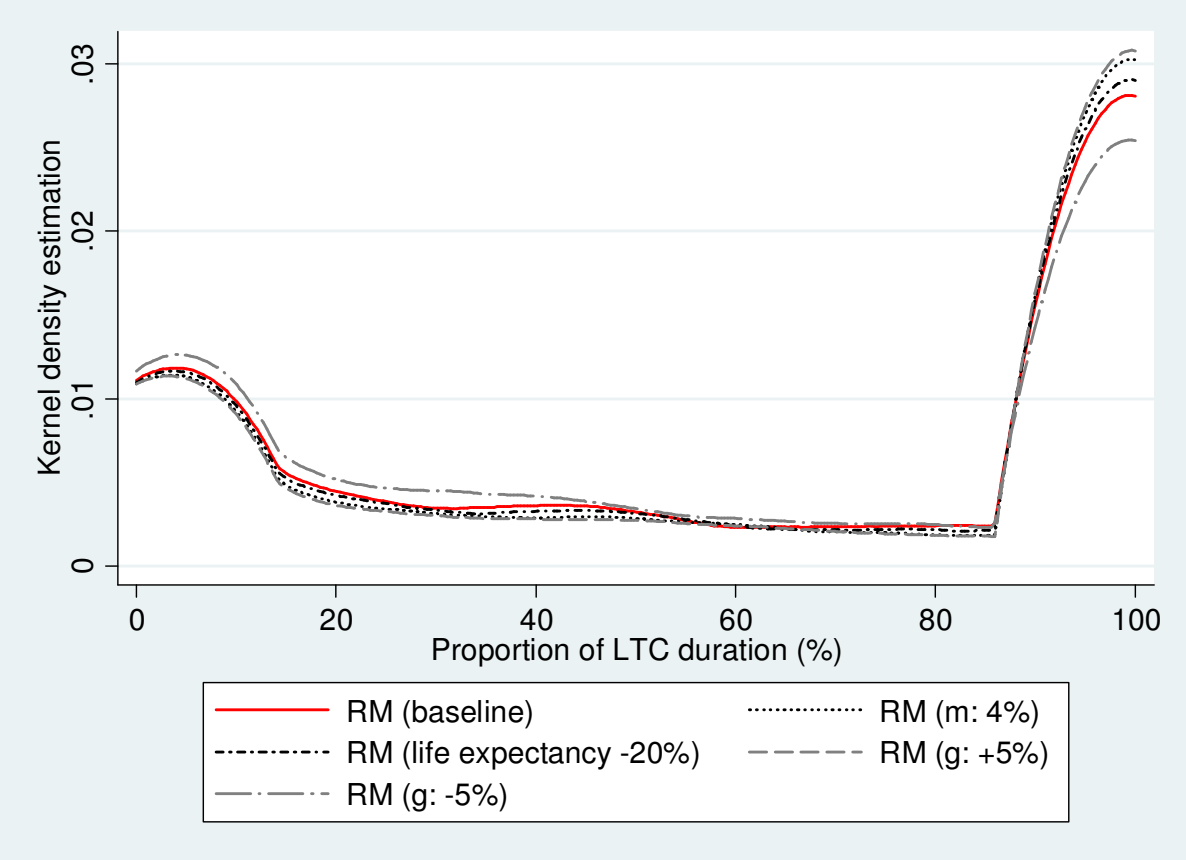
was already computed on the basis of short life expectancies and changing the parameters makes little difference when compared to the annual LTC cost.

Table 14. Effects of a change in RM parameters on ability to pay.

	Lump-sum RM (baseline)	Lump-sum RM (m: 4%)	Lump-sum RM (e: -20%)	Lump-sum RM (g: 5%)	Lump-sum RM (g: -5%)
Total	0.506 (0.009)	0.543 (0.007)	0.521 (0.008)	0.554 (0.007)	0.459 (0.009)
Country					
- Austria	0.413 (0.018)	0.430 (0.017)	0.419 (0.018)	0.435 (0.016)	0.385 (0.016)
- Germany	0.457 (0.013)	0.477 (0.013)	0.465 (0.013)	0.482 (0.012)	0.428 (0.013)
- Sweden	0.502 (0.020)	0.514 (0.020)	0.507 (0.020)	0.519 (0.018)	0.487 (0.019)
- Netherlands	0.524 (0.015)	0.533 (0.014)	0.528 (0.014)	0.537 (0.015)	0.504 (0.016)
- Spain	0.460 (0.018)	0.515 (0.016)	0.482 (0.017)	0.531 (0.016)	0.399 (0.020)
- Italy	0.495 (0.018)	0.554 (0.021)	0.518 (0.017)	0.570 (0.020)	0.426 (0.016)
- France	0.631 (0.015)	0.663 (0.015)	0.646 (0.015)	0.671 (0.014)	0.586 (0.015)
- Denmark	0.426 (0.007)	0.451 (0.011)	0.436 (0.009)	0.457 (0.010)	0.400 (0.007)
- Belgium	0.669 (0.013)	0.694 (0.013)	0.681 (0.015)	0.700 (0.013)	0.639 (0.014)
Number of observations: between 7,568 and 7,698 depending on the simulation.					

Source: SHARE, authors' microsimulation.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent.
The figures given correspond to the mean of the (weighted) ability to pay across 10 replications of simulations. Standard deviations between the means of the 10 replications are in parentheses.

Figure 7. Effects of a change in RM parameters on the distribution of ability to pay.



Source: SHARE, authors' microsimulation. All countries.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent (7,620 individuals).
The distribution corresponds to the 10th simulation. Weighted distributions.

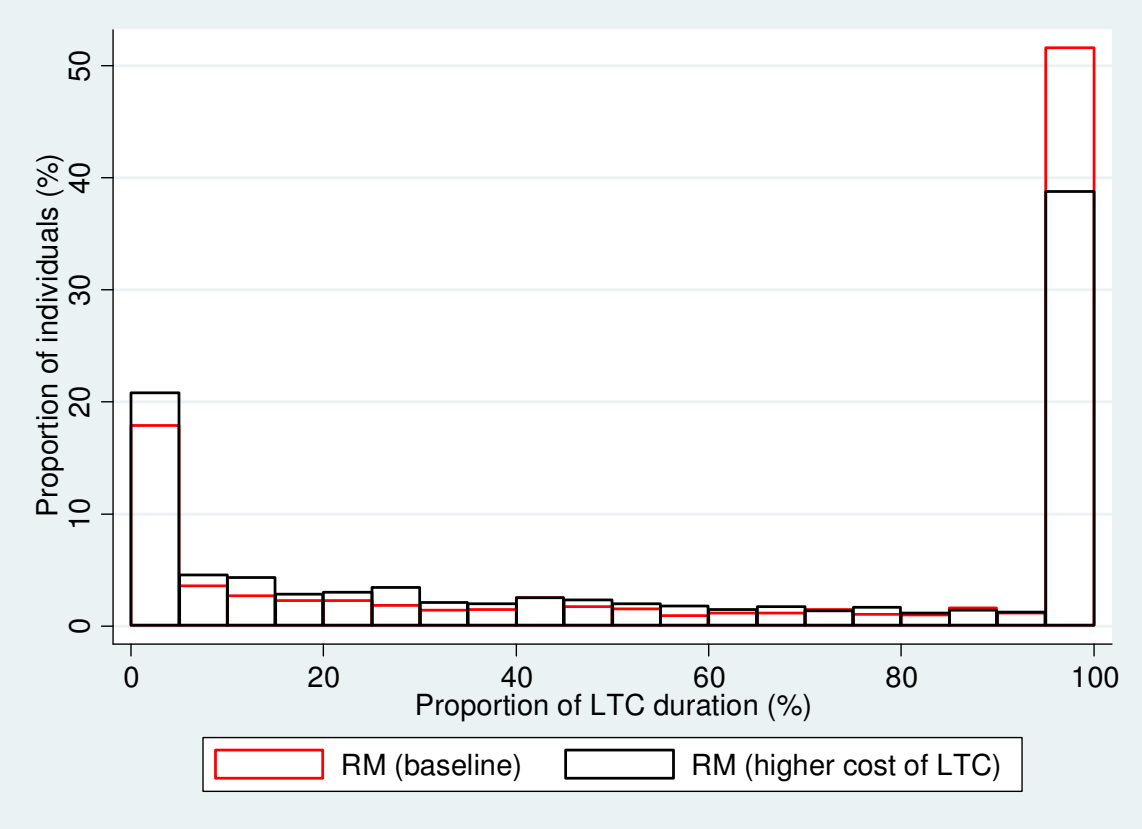
By contrast, an increase in the annual cost of LTC would have a strong negative impact on the ability to pay (see Table 15 and Figure 8). Only 37.5% of individuals would be able to meet their long-term care needs, as compared to 51% in the baseline scenario.

Table 15. Effect of an increase in the annual cost of LTC.

	Equivalised household income	+ Net financial assets	+ Other real estate	+ Lump-sum RM
Baseline				
Total	0.071 (0.004)	0.176 (0.005)	0.234 (0.005)	0.506 (0.009)
Country				
- Austria	0.091 (0.006)	0.167 (0.014)	0.210 (0.015)	0.413 (0.018)
- Germany	0.126 (0.007)	0.243 (0.008)	0.256 (0.008)	0.457 (0.013)
- Sweden	0.116 (0.014)	0.339 (0.017)	0.395 (0.019)	0.502 (0.020)
- Netherlands	0.157 (0.015)	0.340 (0.016)	0.352 (0.015)	0.524 (0.015)
- Spain	0.017 (0.005)	0.048 (0.008)	0.149 (0.015)	0.460 (0.018)
- Italy	0.018 (0.002)	0.064 (0.007)	0.151 (0.010)	0.495 (0.018)
- France	0.078 (0.011)	0.276 (0.016)	0.334 (0.008)	0.631 (0.015)
- Denmark	0.037 (0.006)	0.222 (0.008)	0.274 (0.008)	0.426 (0.007)
- Belgium	0.163 (0.015)	0.385 (0.013)	0.428 (0.012)	0.669 (0.013)
Higher annual LTC cost (hourly labor cost in "Human health and social work activities", Nace Rev. 2 Section Q)				
Total	0.025 (0.002)	0.097 (0.004)	0.151 (0.005)	0.375 (0.010)
Country				
- Austria	0.017 (0.003)	0.056 (0.007)	0.101 (0.009)	0.272 (0.015)
- Germany	0.033 (0.005)	0.111 (0.005)	0.134 (0.005)	0.320 (0.011)
- Sweden	0.049 (0.011)	0.226 (0.020)	0.290 (0.022)	0.405 (0.023)
- Netherlands	0.038 (0.010)	0.165 (0.022)	0.180 (0.023)	0.375 (0.020)
- Spain	0.004 (0.001)	0.020 (0.005)	0.093 (0.011)	0.301 (0.014)
- Italy	0.004 (0.001)	0.019 (0.002)	0.092 (0.009)	0.346 (0.022)
- France	0.043 (0.007)	0.209 (0.017)	0.270 (0.010)	0.554 (0.015)
- Denmark	0.019 (0.004)	0.160 (0.006)	0.211 (0.009)	0.354 (0.011)
- Belgium	0.119 (0.011)	0.287 (0.015)	0.334 (0.013)	0.575 (0.014)
Number of observations: between 7,568 and 7,698 depending on the simulation.				

Source: SHARE, authors' microsimulation.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent.
The figures given correspond to the mean of the (weighted) ability to pay across 10 replications of simulations. Standard deviations between the means of the 10 replications are in parentheses.

Figure 8. Effect of an increase in the annual cost of LTC on the distribution of ability to pay.



Source: SHARE, authors' microsimulation. All countries.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent (7,620 individuals).
The distribution corresponds to the 10th simulation. Weighted distributions.

Online Appendix C6. The role of informal care and public LTC coverage.

In the main analysis, we have assumed that there was no public coverage for LTC and no informal care. However, in practice, the cost of LTC is generally shared between the dependent elderly, their family (through informal care provision or formal care purchase) and the State (through public coverage)[28]. LTC systems differ across Europe[29] but are generally grouped in three main clusters: Northern countries (Sweden, the Netherlands and Denmark), Mediterranean countries (Spain and Italy) and Central Europe (Austria, Germany, France and Belgium). In Nordic countries, public LTC systems are highly developed and generous. Support for dependent people is mainly professional (through formal home help or in institutions) and informal care is limited. There is no legal obligation to support relatives in Scandinavian countries (Haberkern and Szydlik, 2010). By contrast, in Mediterranean countries, public LTC expenditure is low and the role of the family is important (see Fontaine et al. 2007 and Bonsang 2007 for statistics on care arrangements and time assistance from adult children in different European countries using SHARE data). Central countries are an intermediate (and less homogeneous) group.

Informal care

In the interests of simplification, we do not take into account the diversity of care arrangements in Europe. We simply assume that the LTC cost borne by dependent individuals is 25% or 50% lower when they had children in wave 5. This corresponds to the case where children provide informal care or purchase formal services (voluntarily or due to legal obligation).

In the baseline scenario, by construction; the ability to pay for LTC needs is the same whether one has children or not (Table 16). Assuming that the LTC cost is lower for individuals who have children increases their ability to pay. When the LTC cost is 25% lower, the proportion of individuals with children who can pay for LTC is 58%, compared to 52% for individuals without children. If the LTC cost was 50% lower, 69% of individuals who have children could totally finance their periods of disability. The distribution of the ability to pay (Figure 9) confirms that an individual without children would have more difficulty than a parent paying her LTC expenses under this scenario.

[28] As outlined in the introduction, the private purchase of LTC insurance is rare in most countries. Here, income from private LTC insurance is included.

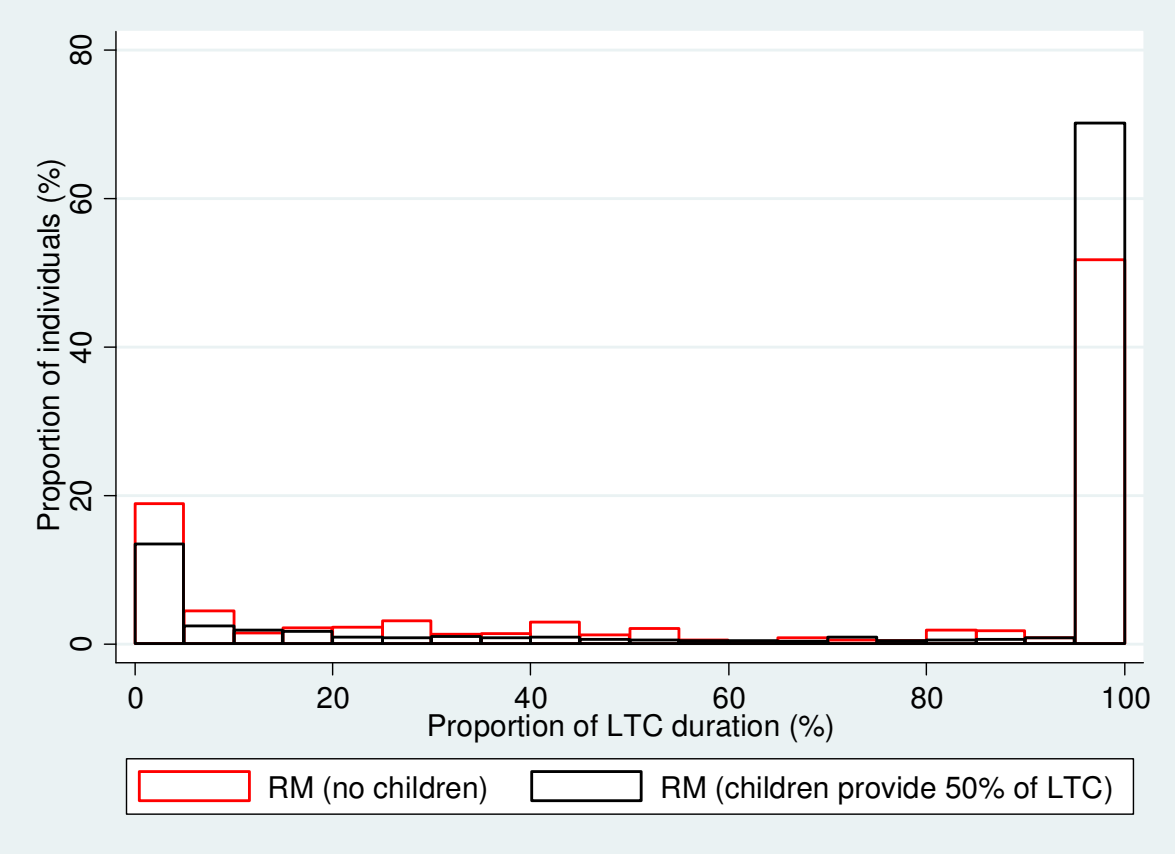
[29] Da Roit and Le Bihan 2010; Colombo et al. 2011; Verbeek-Oudijk et al. 2014; Carrino and Orso 2014; Kraus et al. 2011.

Table 16. Effect of informal care on ability to pay.

		Equivalised household income	+ Net financial assets	+ Other real estate	+ Lump-sum RM
Baseline scenario	Total	0.071 (0.004)	0.176 (0.005)	0.234 (0.005)	0.506 (0.009)
	No children	0.075 (0.012)	0.205 (0.012)	0.255 (0.013)	0.516 (0.014)
	At least one child	0.070 (0.003)	0.171 (0.005)	0.231 (0.006)	0.504 (0.010)
LTC cost -25%	Total	0.121 (0.005)	0.249 (0.006)	0.301 (0.007)	0.574 (0.009)
	At least one child	0.129 (0.004)	0.256 (0.006)	0.309 (0.007)	0.584 (0.011)
LTC cost -50%	Total	0.227 (0.007)	0.359 (0.008)	0.408 (0.008)	0.665 (0.008)
	At least one child	0.254 (0.006)	0.386 (0.008)	0.435 (0.007)	0.691 (0.009)
Number of observations: between 7,568 and 7,698 depending on the simulation.					

Source: SHARE, authors' microsimulation.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent.
The figures given correspond to the mean of the (weighted) ability to pay across 10 replications of simulations. Standard deviations between the means of the 10 replications are in parentheses.

Figure 9. Effect of informal care on the distribution of ability to pay.



Source: SHARE, authors' microsimulation (lower bound of LTC cost). All countries.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent (7,620 individuals).
The distribution corresponds to the 10th simulation. Weighted distributions.

Public LTC coverage

To simulate the effect that public LTC coverage has on social inequalities, we mimic a simple income-tested system and assume that 80% of the LTC cost is publicly covered for dependent individuals in the 1st income quintile, 60% for the 2nd quintile, 40% for the third quintile, 10% for the 4th quintile and 5% for the 5th quintile[30].

While only 7% of individuals can pay for their LTC needs out of their income in the baseline scenario, this proportion more than doubles (16%) when adding public LTC coverage (Table 17). Similarly, the proportion of individuals who can pay for LTC with income and financial assets increases from 18% to 35%. If we add all housing assets, 69% of dependent individuals can totally finance their LTC expenses with public coverage, as compared to 51% in the baseline scenario. Quite obviously, the ability to pay for LTC significantly increases when part of the cost is publicly financed. In addition, since we have assumed that copayments increase with income, public LTC coverage reduces social inequalities (Figure 10). Distributions by income quintile (Figure 11) show that public LTC benefits increase the ability to pay for periods of disability in the first three income quintiles. The ability to pay for 100% of expenses doubles in the two lowest quintiles and is increased by one third in the third one. As expected, there is almost no effect in the two top income quintiles.

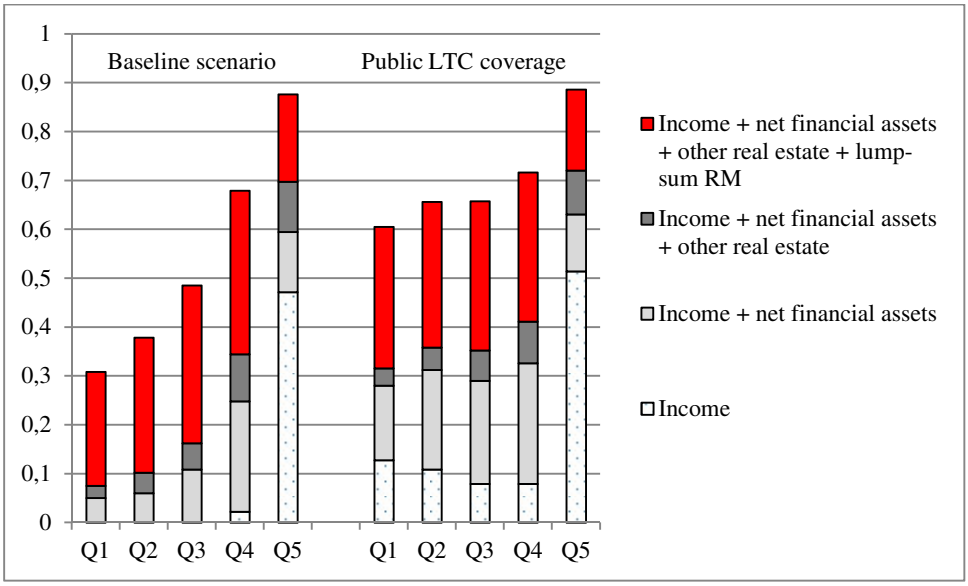
Table 17. Effect of public LTC coverage on ability to pay.

		Equivalised household income	+ Net financial assets	+ Other real estate	+ Lump-sum RM
Baseline scenario	Total	0.071 (0.004)	0.176 (0.005)	0.234 (0.005)	0.506 (0.009)
	Q1	0.000 (0.000)	0.050 (0.005)	0.075 (0.007)	0.308 (0.011)
	Q2	0.000 (0.000)	0.060 (0.009)	0.102 (0.009)	0.378 (0.012)
	Q3	0.000 (0.000)	0.108 (0.008)	0.162 (0.013)	0.485 (0.019)
	Q4	0.022 (0.004)	0.248 (0.012)	0.344 (0.018)	0.679 (0.018)
	Q5	0.471 (0.015)	0.594 (0.014)	0.697 (0.013)	0.876 (0.012)
Public LTC coverage	Total	0.159 (0.004)	0.347 (0.006)	0.406 (0.008)	0.687 (0.008)
	Q1, 80%	0.127 (0.005)	0.280 (0.010)	0.315 (0.011)	0.605 (0.018)
	Q2, 60%	0.108 (0.006)	0.312 (0.014)	0.358 (0.015)	0.656 (0.014)
	Q3, 40%	0.079 (0.007)	0.290 (0.015)	0.352 (0.017)	0.657 (0.021)
	Q4, 10%	0.079 (0.005)	0.326 (0.009)	0.411 (0.014)	0.716 (0.014)
	Q5, 5%	0.514 (0.016)	0.630 (0.015)	0.720 (0.018)	0.886 (0.010)
Number of observations: between 7,568 and 7,698 depending on the simulation.					

Source: SHARE, authors' microsimulation.
Individuals aged 65 and over in wave 5 and who have no partner when they are dependent.
The figures given correspond to the mean of the (weighted) ability to pay across 10 replications of simulations. Standard deviations between the means of the 10 replications are in parentheses.

[30] We abstract from the issue of financing such public LTC insurance system.

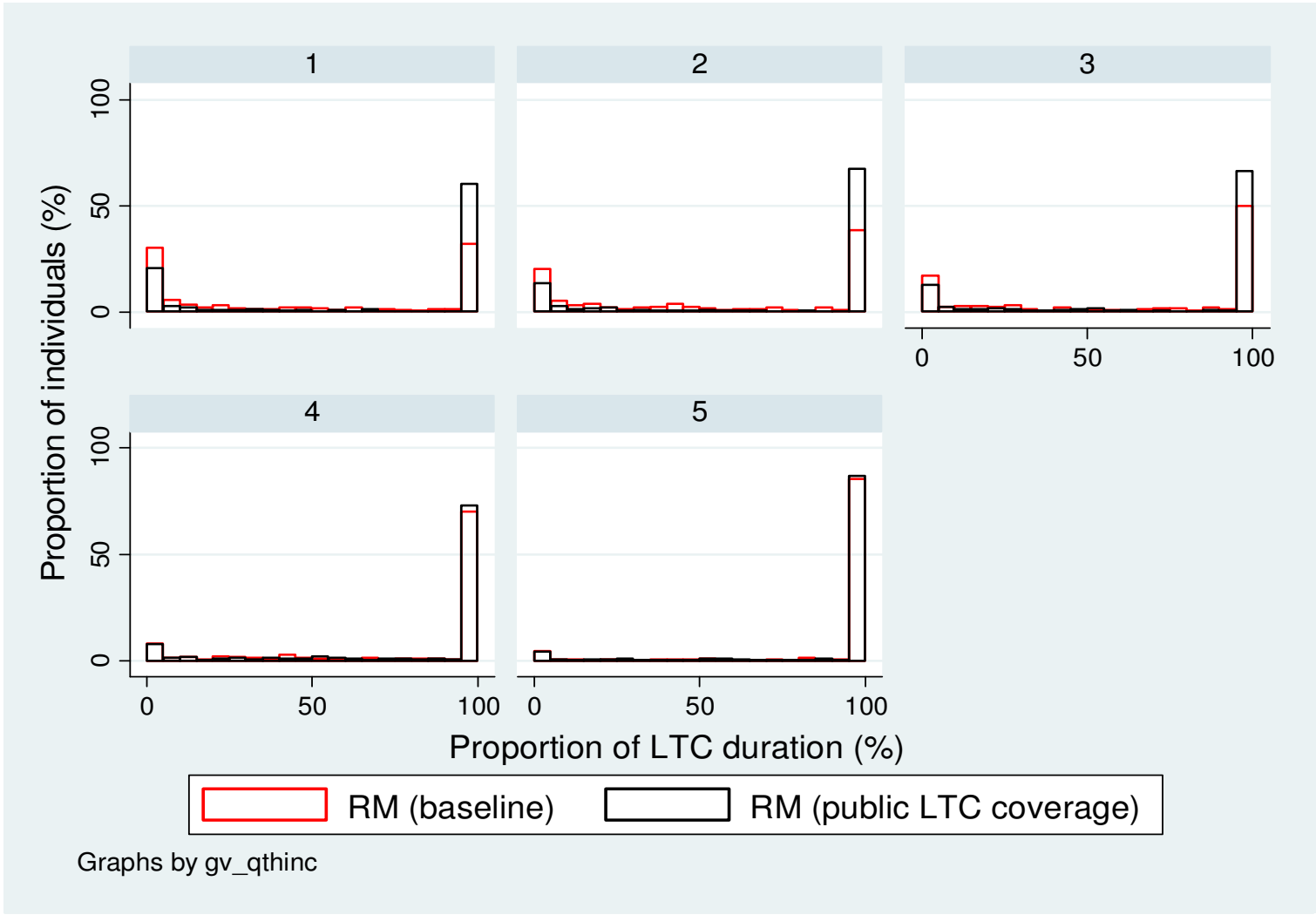
Figure 10. Effect of public LTC coverage on ability to pay.



Source: SHARE, authors' microsimulation. All countries.

Individuals aged 65 and over in wave 5 and who have no partner when they are dependent.

Figure 11. Effect of public LTC coverage on the distribution of ability to pay, by income quintile.



Source: SHARE, microsimulation. All countries.

Individuals aged 65 and over in wave 5 and who have no partner when they are dependent (7,620 individuals).

The distribution corresponds to the 10th simulation. Weighted distributions.

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